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Issue Paper I

PERSPECTIVES OF INTERREGIONAL CO-OPERATION IN THE AGRICULTURAL MACHINERY INDUSTRY, WITH EMPHASIS ON SMALL- AND MEDIUM-SCALE ENTERPRISES*

Prepared by the
UNIDO Secretariat

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I. INTRODUCTION AND BACKGROUND

1. As a result of the global economic recession the agricultural machinery industry is experiencing a sharp reduction in world demand, especially for tractors and combine harvesters, but also for most items of tractor-drawn equipment. This is true in the majority of developing countries; therefore, their markets have not proved to be the abundant source of fresh demand on which manufacturers in the developed countries had been relying.

2. The reduction in market size has resulted in very severe competition and a deterioration in the situation of manufacturers. World production capacity has had to take account of the reduction in demand; however, available supply is still some 20 per cent in excess of the present effective demand.

3. These difficulties have led large manufacturers to formulate new strategies. The companies that are most highly organized at the world level are entering into technical, economic and commercial agreements with one another that result in the exclusion of newcomers from the market. As shown by indicators such as the concentration of plants, the transnational companies prefer to maintain their hold on areas in which they have experience and are solidly established (e.g. large motorized equipment) rather than to diversify or seek breakthroughs in markets that they consider limited.

4. Small- and medium-scale enterprises in developed countries, although they have unused production capacity which could be mobilized for joint ventures or licensing contracts, are reluctant to transfer their expertise for product design and manufacturing, primarily because they lack the experience in developing countries and information necessary to enable them to enter into such agreements with confidence.

5. The future of the world agricultural machinery industry depends on the quantitative and qualitative development of its markets and, in particular, on the models of agricultural mechanization adopted by countries. The models

adopted are closely interrelated with the agricultural and industrialization policies and methods of manufacturing of these countries. The dominant model to date has been heavy mechanization, using tractors coupled with tractor-drawn machines, which has been widely adopted in developing countries, often without giving adequate consideration to local conditions.

6. In this context, as has been shown at previous Consultations and meetings on the agricultural machinery industry, agricultural machinery and equipment has to be considered in the broadest sense, covering a wide spectrum of products from hand tools, animal-drawn implements, and hand-operated machines, irrigation equipment and crop protection machinery; to power machinery and equipment such as tractors, power tillers, engines and combines, as well as specialized single-purpose machines and equipment. Also included is the equipment needed for storage, transport and primary processing of agricultural raw materials. 1/

7. In the majority of developing countries the model of heavy agricultural mechanization runs into various obstacles: structural (the size of farms), ecological (fragile tropical soils), financial (solvency of farmers), etc. These obstacles make it necessary to develop other policies directed towards food self-sufficiency, such as the intensification of agricultural production. In this case, agricultural mechanization must be implemented on the basis of diversified capital goods designed for small, decentralized farms with little specialization, an abundant labour force, and limited financial resources. Neither the supply from industrialized countries nor the range of products marketed by the transnational corporations is appropriate to satisfy these needs. Moreover, imported equipment frequently poses many difficulties for developing countries. Equipment and machinery designed and manufactured in developed countries often has to be modified or completely redesigned to ensure mechanical reliability and suitability to local conditions, a process which proves to be highly costly and inefficient.

1/ See: "The agricultural machinery industry in the 1980s: factors for international co-operation" (ID/WG.400/1).

8. In addition to the structural, ecological, financial and other problems encountered by the heavy tractorization model, this model has not been able to increase agricultural output sufficiently in developing countries. The annual rate of growth of agricultural output in developing countries in the past decades was just 3 per cent, and due to the rapid population growth in this period, per capita output growth was only 0.3 per cent per year. This average conceals considerable differences; the per capita output growth rate was 1.4 per cent in South-East Asia, 0.6 per cent in Latin America, and -1.1 per cent in Africa. 2/

9. FAO has estimated that, in order to be able to meet the triple challenge posed by hunger, increasing population, and underdevelopment by the year 2000, agricultural production in the developing countries would have to increase by an average of 3.9 per cent per year, instead of 2.6 per cent as it has over the last decade.

10. Agricultural machinery manufacturing is a branch of industry which can make a major contribution to increasing both agricultural production and industrial output in developing countries. However, the present share of developing countries in the total world production of all types of agricultural equipment is estimated to be only approximately 6 per cent.

11. At present in Africa, local production of agricultural machinery covers only 5 per cent of the total apparent demand of about $ 1.5 billion per year; as a result the market is dominated by imports. In view of the balance of payments constraint on imports of capital goods in many developing countries, it is clearly to their advantage to fulfil as much of their demand as possible through domestic production rather than through imports. Developing the agricultural machinery industry would also serve as an entry point to the capital goods industries, while meeting the priority needs of farmers and helping to increase food production.

2/ See: World Bank, Toward Sustained Development, A Joint Programme for Sub-Saharan Africa, 1984.

12. Thus, it is clear that there is a need to strengthen the indigenous capacity for production and maintenance of agricultural machinery and implements suited to local farming methods. The achievement of this goal would require the introduction of appropriate technology, making use of local resources and manpower. Agricultural machinery development in Africa should be conceived so as to increase both the quantities and range of products manufactured as well as to increase the value added.

13. Large investments will be necessary to achieve these goals. The costs of these investments are undoubtedly beyond the present financial capabilities of African countries and will require external assistance in finance, transfer of technology, research and development, and training. This assistance can only be achieved through co-operation between developed and developing countries, and between the developing countries themselves.

II. A NEW APPROACH TO MEET THE NEEDS OF DEVELOPING COUNTRIES

14. Taking into account the need for appropriate/intermediate technologies to meet the diverse needs of developing countries, greater efforts should be made to locate alternative sources of supply of agricultural machinery and implements and assistance in developing domestic production capacity. Increased trade and co-operation with other developing countries could also enlarge the markets served by the producer countries, which is essential for achieving economies of scale in production and would be of mutual benefit to all concerned.

15. Considering the development experience of Asia and Latin America and the Caribbean in the field of agricultural machinery in relation to that of Africa, it is necessary to examine the industrial possibilities and technical capabilities in each region and identify industrial complementarities between regions with the objective of proposing practical mechanisms to facilitate interregional co-operation. 3/

3/ See: "Report of the Expert Group Meeting on the Establishment of Multinational Production Enterprises in Developing Countries, 25-28 November 1985" (UNIDO/PC.133).

16. The probability of sucess in joint undertakings for the production of agricultural machinery is most likely to be higher between countries with similar agro-ecological conditions. Over the years each developing country has developed some strengths, not only in importing and assimilating technologies, but also in developing appropriate manufacturing technologies and products or building research and development institutions. It should be of great interest to assess these strengths and to explore possibilities of co-operation to enhance them for the mutual benefit of the countries involved.

17. Many of the more advanced developing countries such as Algeria, Argentina, Brazil, India, Malaysia, Mexico, Thailand, Turkey, Yugoslavia and Zimbabwe have progressed in producing and assembling certain types of agricultural handtools (hoe, pickaxe, shovel, etc.), animal- and tractor-drawn implements (plough, seeder and fertilizer drill, etc.), power tillers, tractors, combine harvesters and other machines and equipment that are appropriate to the requirements of developing countries. This was based on the formulation and implementation of deliberate policies of agricultural development and mechanization by the Governments of these countries.

18. However, so far, interregional co-operation between developing countries is rather limited, particularly with African countries, due to their strong orientation towards neighbouring subregional and regional markets and the lack of finance for trade guarantees and for potential investments abroad.

19. Furthermore, existing co-operation between developing countries is restricted mainly to trade, not production, and is mostly of an intra-regional nature. In 1980 the exports of agricultural machinery from 13 developing countries amounted to nearly $ 163 million (at constant 1975 prices). The share of Latin America in these exports was 88 per cent, of which 85 per cent was accounted for by Brazil alone, followed by Argentina, Mexico, Colombia and El Salvador. Asia's share was about 11 per cent, led by Singapore which accounted for about one third of the exports of agricultural machinery by Asian developing countries. Africa's exports were less than 1 per cent of the

total. About 80 per cent of developing countries' exports of agricultural machinery are directed to other developing countries, the majority of those being intra-regional trade. 4/

20. From the above it appears that South-South co-operation has been more effective at the subregional and regional levels than at the interregional level. A number of factors including geographic proximity, certain common traditions and cultural ties would tend to explain the present status of co-operation.

21. Intra-regional trade is expected to be the main growth area in Asia and Latin America and the Caribbean. However, producers in these regions are also expected to increase their penetration of markets in the Near East and Tropical Africa, where the South supplied less than 6 per cent of total imports of capital goods, including agricultural machinery, in 1979. Some countries, such as Brazil and India, have begun to supply other developing regions; about 30 per cent of the latter's exports went to African countries.

22. The experience gained in intra-regional and interregional trade should be reviewed and co-operation should be expanded, based on a consideration of the advantages to be gained from an exchange of appropriate technologies and experience in product designs, manufacture, use, repair and maintenance, and research and development in the field of agricultural machinery and implements.

23. A survey of users, dealers and producers of agricultural machinery in different African countries conducted on behalf of UNIDO confirmed that products manufactured in countries with similar climatic and soil conditions (e.g. Asia, Latin America and the Caribbean) can be profitably adapted for use under African conditions. It was also observed that manufacturing technology transferred from other developing countries is more appropriate to the local production environment of developing countries, particularly in Africa. 5/

4/ See: "A survey of Latin American agricultural machinery industry" (UNIDO/IS.407), 1983.

5/ See: "Perspectives of South-South co-operation in the agricultural machinery industry" (ID/WG.462/9).

24. The survey showed further that in African countries it was seen as advantageous to upgrade existing plants and develop medium-sized units for the production of animal-drawn implements and hand-operated machines, using intermediate technology and producing in small series, instead of creating large-scale units, because of the present limited size of markets.

25. Small- and medium-scale manufacturers in more advanced developing countries and industrialized countries can play a significant role in co-operation programmes for the development of the agricultural machinery industry directed towards achieving the long-term goal of self-reliance in the sector. The small- and medium-scale enterprises of developed countries, because of their ability to adapt their production to demand and their capability of manufacturing a wide range of products, have the necessary flexibility to transmit many innovative ideas to meet the diversified needs of developing countries using new forms of industrial co-operation.

26. There is thus a scope and potential for the expansion of economic and technical co-operation on a South-South basis with emphasis on small- and medium-scale enterprises. For example, in other more advanced developing countries and developed countries an efficient small-scale industrial sector has been developed that could be of tremendous interest to African countries. Small-scale industries tend to bring about a more broadly-based industrial growth and development in a country. They also tend, in some cases, to have higher manufacturing value added than larger-scale industries, and, moreover, tend to use primarily local raw materials in production. Further, they have a high employment-generation effect, particularly in rural areas.

27. For these and other reasons, co-operation between Africa and Asia and Latin America and the Caribbean should be given careful consideration, provided that the constraints and difficulties hampering such co-operation can be minimized, if not completely eliminated. Besides the lack of infrastructure, technological capability and trained manpower, the main constraints which specifically hinder interregional co-operation for the development of the agricultural machinery industry in developing countries, particularly in Africa, are a lack of capital for the required investments,

small and widely scattered markets, and insufficient exchange of information. 6/ These problems could be solved through co-operation among producers at national, subregional, regional and interregional levels. The problem of small domestic markets could be overcome at subregional and regional levels by pooling markets and rationalizing production within regions and sub-regions.

28. As regards the shortage of foreign exchange for acquiring technology, equipment, technical services and other inputs that have to be imported, developing countries should also consider the development of additional possibilities for countertrade, which has at present reached about 30 per cent of total world trade 7/, as a means for financing imports.

29. In order to promote regional and interregional co-operation, Governments of developing countries should define, adopt and implement industrial policies and strategies that facilitate the integration of markets and provide such resources as finance, manpower and technology needed for the promotion of the agricultural machinery sector. Effective industrial support is required, involving, among other things, clear and precise formulation of agricultural mechanization policies, plans and programmes, industrial information and training, and industrial and trade promotion, with the aim of establishing a framework for industrial co-operation in accordance with national development objectives.

30. The Industrial Development Decade for Africa (IDDA) represents a positive framework for co-operation. The commitment of the Heads of State and Government of the Organization for African Unity (OAU) in the Lagos Plan of Action is to accord the major role to industry, reaffirming their determination to change the economic structure of Africa. In this process,

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6/ See: "Strategies for an integrated development of agriculture with local production of irrigation hardware and other agricultural equipment by small- and medium-scale manufacturers" (ID/WG.462/5).

7/ This estimate is taken from the study "The World of Countertrade" by the American Institute of Business Trend Analysis, 1983.

highest priority is given to achieving food self-sufficiency by providing the necessary physical and economic policy conditions for utilizing all the land suitable for cultivation. The second priority is to promote a gradual economic integration at the regional level and to co-ordinate development policies of various countries grouped together geographically, not only to facilitate the creation of preferential subregional markets, but also to co-ordinate the economic policies of African countries in negotiating with non-African economic partners. The goal of the Lagos Plan of Action is the development of industrial activities at the subregional level. Economic integration should be achieved through the creation of effective linkages between industry and agriculture, by providing the infrastructure of agricultural machinery and equipment in the broad sense, that is, irrigation, food processing, storage, and other related equipment. 8/ Programmes of country specialization in production of agricultural inputs are already established. These intra-regional programmes should facilitate co-operation with African partners by taking advantage of the enlarged markets they provide within regional groupings, such as the Preferential Trade Area in Eastern and Southern Africa (PTA) and the Economic Community of West African States (ECOWAS).

III. POINTS FOR DISCUSSION

31. Within the framework of changes in the world economy, the development of the agricultural machinery industry in developing countries in general and in Africa in particular should be based on increasing self-reliance, co-operation between developing countries and co-operation between developing and developed countries. The participants at the Consultation, in their deliberations

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8/ See: ID/WG.462/5, op.cit.

directed towards arriving at a clearer understanding of the problems related to the sector and consideration of measures for overcoming these problems, are invited to focus their discussions on the following points:

(a) The assessment of specific possibilities for interregional co-operation between developed and developing countries and between developing countries themselves, with emphasis on small- and medium-scale enterprises involved in the development of the agricultural machinery industry;

(b) Analysis of the main internal and external constraints with the objective of facilitating and improving such co-operation;

(c) Development of co-operation on building up and strengthening of institutions dealing with training, design, research and development, repair, maintenance, etc. One possibility that should be examined in this context is the twinning of institutions in the developing countries with those of industrialized countries or of other developing countries, with specific interlinked work programmes. A further possibility that should be considered is the promotion of subregional and regional networks of these institutions.

(d) Identification of main aspects (technical, economic, legal) to be considered in order to establish a framework for industrial co-operation. In this context, it is necessary to examine the possible role of regional development banks in financing such co-operation as well as the possible contribution of UNIDO and other international organizations to the establishment of that framework.

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PERSPECTIVES OF INTERREGIONAL CO-OPERATION IN THE AGRICULTURAL MACHINERY INDUSTRY, WITH EMPHASIS ON SMALL- AND MEDIUM-SCALE ENTERPRISES

Corrigendum

Page 10, footnote 6, line 3 and page 11, footnote 8

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Issue Paper II

STRATEGIES FOR AN INTEGRATED DEVELOPMENT OF AGRICULTURE WITH LOCAL PRODUCTION OF IRRIGATION HARDWARE AND OTHER AGRICULTURAL EQUIPMENT BY SMALL- AND MEDIUM-SCALE MANUFACTURERS*

Prepared by the
UNIDO Secretariat

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BACKGROUND

1. Agricultural mechanization is playing a role of growing importance in increasing food production in most developing countries. World population is increasing at a faster rate than is food production. It is estimated that by the year 2000 the world population will further increase by approximately 2 billion, thus reaching between 6 and 6.5 billion. Approximately 80 per cent of that population growth will take place in developing countries. Furthermore, the continuous migration from rural areas to urban centres will result in increasing scarcity of labour for agriculture. All developing countries, therefore, have given high priority to the satisfaction of the basic needs of their population and are concentrating their efforts on achieving food security and national self-sufficiency in food production. It is clear that these goals can only be achieved by a number of policy changes, including an active policy aimed at farm mechanization appropriate to the physical, cultural, economic and technological environment of a country or region.

2. Mechanization is one of the main factors to be considered, together with other elements of agricultural development, in achieving a significant increase in land productivity and ultimately in raising the nutritional levels of the population. The agricultural machinery industry has an important role to play in producing the machinery needed to optimize the use of inputs for and outputs from agricultural production. Therefore, planning a more integrated development between agriculture and the agricultural machinery industry can permit each sector's growth to encourage and reinforce the growth of the other.

3. Irrigation is one of the main pillars of agricultural development. Depending on topographical conditions, pumping is often an essential element in irrigation, land reclamation and drainage. In developing countries where agricultural development is given highest priority, the pump and other irrigation equipment should be considered together with other agricultural machinery and related common-purpose capital goods (see annexes 1 and 2). Pump manufacturing should be examined in the context of the multi-purpose approach to the manufacture of agricultural machinery, which was recognized by the Second Consultation on the Agricultural Machinery Industry as a valuable approach for most developing countries.

4. Depending on local conditions, the demand for various types of irrigation equipment and components will differ from one country to another, which means that the required manufacturing facilities and the degree of manufacturing complexity may also differ.

INTRODUCTION

5. The economies of African countries are based primarily on agriculture, with limited levels of industrialization both in engineering and in the allied metal working sector.

6. Analysis by UNIDO of the manufacturing sector in developing countries has shown that in Africa the share of local producers (the rate of self-sufficiency in manufacturing) is only 5 per cent. This is a serious problem since the manufacturing sector is of major importance in providing essential inputs to satisfy the basic needs of the population related to food production and food security.

7. This situation has been aggravated by many factors including the continuing global recession, which has limited the effectiveness of efforts by African countries to increase agricultural production and has slowed progress towards achieving the economic and agricultural development required to attain self-sufficiency in food production.

8. The capacity of developing countries, particularly in Africa, to formulate and implement appropriate or selective mechanization policies is of crucial importance to the improvement of their agricultural productivity.

9. Constraints arising from the lack of adequate policies and strategies, small market size, limited technological capability, as well as a lack of financing, negotiation skills, training, standardization, etc., hinder the development of local production of agricultural machinery.

I. MANUFACTURING POLICIES AND STRATEGIES

10. Decisions related to the manufacture of agricultural equipment in general and irrigation equipment and components in particular require in-depth investigation and feasibility studies in each case in order to select the optimal product mix. The product mix might be different from country to country, owing to variability of local conditions, e.g. agricultural structure, soil conditions, crops grown, land ownership arrangements, etc. The existing technical infrastructure, economy and agricultural system must be considered in working out a proper strategy for integrated development of the industry.

11. From an industrial perspective, policies and strategies for the manufacture of agricultural equipment and irrigation components should be considered within the context of the capital goods sector as a whole. This requirement is another reason why integrated planning of agriculture and industry in general, and the agricultural machinery subsector in particular, is very important.

12. For countries where the industrial base is relatively limited, the multi-purpose approach should be carefully considered, i.e. the local manufacture of pumps for agricultural and other uses should be accompanied by a wider range of other manufacturing activities than is usually the case in developed countries in order to justify the required investment and to achieve better utilization rates, providing at the same time the other elements of agricultural mechanization.

13. The development of a domestic agricultural machinery industry calls for, first and foremost, a considerable effort on the part of developing countries themselves. Through such an effort they can build up their human resources and an industrial base that enables them to negotiate with the owners of technology and increase their participation in project development.

14. As the various types of agricultural machinery, including irrigation equipment and components, are of different manufacturing complexity, the economies of scale of manufacturing them are also different. Local conditions such as technical infrastructure, possibilities of interlinkages, availability of component inputs, price structures, selected degree of integration, etc., also have an impact on the economy of scale of manufacturing.

15. Therefore, in each particular case, an optimal degree of integration for various irrigation components in each developing country must be selected. Market demand, the level of technical skills, and the possibilities of interlinkages with other industrial sectors have considerable impact on an optimal degree of integration, i.e. on decisions about whether to manufacture components or to purchase them from a domestic or foreign supplier.

16. The importance of agriculture is now acknowledged; it is therefore essential that high priority must be given in most developing countries to strengthening the agricultural base before a large-scale programme of industrialization is launched. This is essential for generating the surplus needed for the growth of industry and other sectors, as well as for raising the low standards of living of large segments of the population, most of whom live in rural areas.

17. But the development of agriculture also requires related investment in transport, power and water resources, as well as in other sectors. In the long run, if agriculture is to progress, industry has to expand to produce the fertilizer, pesticides, machinery and implements, and auxiliary services required by agriculture.

18. Owing to the pivotal role of the agricultural machinery industry as the interface between agriculture and industry, its development is of crucial importance for improving and expanding domestic production of a wide range of agricultural tools, machinery and implements, including: hand tools; animal- and power-driven implements; irrigation pumps and pipes; sprayers; dusters; crop-dryers; handling, processing and storage equipment; and tractors.

II. THE IMPORTANCE OF DOMESTIC PRODUCTION AND POSSIBLE APPROACHES FOR ITS EXPANSION

19. Several developing countries are still paying dearly and in foreign currency for irrigation pumping equipment. The scarcity of foreign currency in many developing countries creates such a distorted price structure that the purchase price of pumps for the farmers in those countries is often several times the price in the supplier's country.

20. The high cost of importing and maintaining pumping systems may cause feasible agricultural undertakings to be deferred. Sometimes the lack of spare parts renders imported equipment useless. Pumping equipment tends to wear out and break down rather often, particularly the small units operated by individual farmers. Additionally, pumps often require imported sources of energy. For these reasons, where there is a choice to be made between gravity irrigation and pumping, gravity is often prefered.

21. Local production of pumping units can lead to reduced costs for repair and maintenance. Therefore, local production of pumping equipment, together with appropriate financing arrangements for farmers to purchase it, can be crucial to the development of agriculture-based economies.

22. The manufacture of most agricultural machinery, including irrigation components, requires some specialized facilities; often different technologies of varying complexities are used in the manufacturing process. The principle of multi-purpose plants should therefore be considered as a nucleus. As demand increases and progress is made in the mastering of technologies, new specialized units can take over the manufacture of individual products from multi-purpose units.

23. Multi-purpose facilities can be suggested for the production of fittings, water supply and distribution equipment such as pumps, valves, etc., as well as for light agricultural equipment such as rice hullers, dryers, threshers, power tillers, etc. The different production facilities used for different products can be integrated into one multi-purpose plant divided into different shops.

24. Existing multi-purpose plants for the manufacture of capital goods in many developing countries could also be used for the production of specific irrigation components. This would necessitate the planning and organizing of the existing units for these purposes. 1/ For example, quick-coupling irrigation pipes and pumps with light agricultural machinery can be manufactured in the same production facilities by purchasing the required casting products.

25. In this regard, small- and medium-scale enterprises can offer some advantages in comparison to large companies as follows:

(a) Flexibility to respond to market opportunities;

(b) Possibility of being technically more daring and innovative;

(c) Tendency to rely more on sub-contracting within the country, based on technology unpackaging, which facilitates more integration into the local economy.

26. Small- and medium-scale enterprises in developed and more advanced developing countries could play an important role in areas such as transfer of technology, training and financing.

27. In joint agricultural machinery manufacturing projects, small and medium-sized companies seem to be more flexible in negotiating, and the decisions in each phase can often be taken more rapidly, without as many internal regulations and constraints. This is true for both sides, i.e., technology suppliers as well as technology receivers.

1/ For further details see: "Guidelines for the establishment of the multi-purpose agricultural machinery plant", (ID/WG.462/4).

28. The technologies involved in the manufacture of ordinary pumps are generations old and non-proprietary. A good mechanic equiped with casting, machining and welding capabilities, etc., can make centrifugal pumps of the types commonly used by farmers by copying. This is totally different from the copying of patent-protected products, a practice which should be curbed in the environment of international co-operation. Copying prototypes could even be down-engineered if necessary to suit available capabilities and sold to local manufacturers.

29. Training for the development of the agricultural machinery industry in developing countries is of crucial importance. Training is an investment that necessitates long-term planning; it should start at the very beginning, prior to the implementation of joint projects. This requirement necessitates the training of personnel from developing countries at the manufacturer's or supplier's plant and their full participation in production activities, including product development and adaptation as well as prototype fabrication and testing. Developing countries should develop an integrated programme of training for local producers and users of agricultural machinery. In this connection, there are a large number of medium-scale companies in developed countries, some of them specialized in training, that can play a major role in providing training programmes for developing countries in each area of specialization.

30. Financing is one of the major constraints to the development of the industrial sector in general and the agricultural machinery manufacturing subsector in particular in developing countries. However, if highest priority were given to the local manufacture of agricultural machinery, including irrigation equipment, as a key factor in the intensification of cropping needed to achieve food security and self-sufficiency in food production, the financial constraints could be overcome in most developing countries. Choosing an appropriate policy and strategy for allocating the available resources and exploiting the possibilities offered by international institutions such as the World Bank, the International Fund for Agricultural Development (IFAD), the Asian Development Bank, the African Development Bank, the Arab Bank for Economic Development in Africa (BADEA), etc., and other sources can contribute to solving the problems of financing.

31. Technology ownership and manufacturing in the agricultural machinery sector, particularly for tractors and other heavy complex machines such as combine harverters etc. is highly concentrated in developed countries and in a few more advanced developing countries. Equipment and machinery produced in developed countries by large manufacturers have reached a size and sophistication that is frequently not suited to conditions in developing countries, and therefore cannot meet the real needs of these countries. However, many simpler agricultural machinery products such as hand tools, tanks, simple pumps, sprinklers etc. (see Annexes 1 and 2) are produced by small- and medium-scale enterprises, in developed and developing countries. These enterprises offer an extremely useful source of technology and know-how. Therefore emphasis should be placed on the potential offered by these manufacturers both in developing and developed countries whose experience, expertise and flexibility of action have so far not been fully exploited.

III. POINTS FOR DISCUSSION

32. In considering the importance of agriculture in the industrialization process of developing countries and the need to promote a more integrated development between agriculture and industry, the following questions arise:

(a) What factors must be considered in working to achieve a reasonably balanced development of agriculture and industry?

(b) How can the international community assist developing countries to develop possible models for an integrated planning of agriculture and industry in general and the agricultural machinery industry in particular?

33. In relation to irrigation systems, small-scale irrigation schemes with full local participation are winning the confidence of African Governments looking for solutions to the problems of hunger and desertification. Depending upon the pattern of agricultural development and level of mechanization in a country, and with the aims of increasing self-reliance and minimizing the use of foreign exchange, the following factors should be examined in relation to small-scale irrigation:

(a) Supply and production of machinery and components:

(i) Estimates of the type and amount of agricultural machinery in general and irrigation equipment in particular needed to achieve the socio-economic goals of a country or a region;

(ii) Identification of specific industries necessary for the domestic production of the machinery, equipment and implements needed in order to develop the local agricultural sector;

(b) Guidelines for determining the optimal degree of integration (decisions regarding domestic manufacture of parts and components or buying from external sources) for the manufacture of agricultural machinery including irrigation components in developing countries and the promotion of domestic participation in irrigation projects. 2/

34. In relation to the problem of stimulating demand for agricultural machinery in developing countries in general and in Africa in particular, the following questions should be answered:

(a) Can small markets be pooled at the sub-regional and regional levels?

(b) To what extent is consolidation of production (i.e. standardization of equipment) feasible?

(c) What would be the means, internal and/or external, to achieve these objectives?

2/ For further details, see document: "Technological dependency and choice of pumping technologies for irrigation systems" (ID/WG.462/1).

35. In relation to possibilities for co-operation between small- and medium-scale enterprises of developed, more advanced developing and developing countries the following questions should be considered:

(a) What could be the benefits of and possibilities for regional, interregional and international co-operation involving the exchange of technical and commercial information, training, financing, joint ventures and/or multinational production enterprises?

(b) What are the barriers to co-operation between developing countries in the sector and how could the international community contribute to the promotion of this co-operation (rehabilitation, upgrading, and/or creation of new plants)?

36. Considering the importance of rural development to the majority of developing countries, and in particular the importance of developing rural water supplies, the following questions should be examined:

(a) What is the impact of water on rural development and what are the centralized and decentralized alternatives for rural water supply with possible maximum local participation?

(b) How could rural and other small- and medium-scale manufacturing units be involved in simple irrigation pumping systems and other energy-related capital goods projects initiated by national or multilateral sources?

ANNEX 1

AGRICULTURAL MACHINERY PRODUCED IN DEVELOPING COUNTRIES

The term "agricultural machinery" is defined in three broad-based categories, as follows:

Category	Definition
I. (simple)	Hand tools: hoe, machete, spade, weeder, knife, sickle, axe, pick-axe, shovel etc. Manually operated equipment: pedal thresher, hand sprayer, corn sheller, cassava puller and chopper, hand pump, chaff cutter, storage bins etc. Animal-drawn implements: plough, cultivator, leveller, ridger, seeder and fertilizer drill, pump, sugar-cane crusher, reaper, cart etc.
II. (intermediate)	Tractor-drawn basic implements: plough, cultivator, harrow, leveller, seed drill, reaper, trailer etc. Simple, low-cost low-power equipment: power thresher, pump, chaff cutter, corn sheller, peanut decorticator, rice mill, hammer mill, power tiller, low-power engine etc.
III.(standard)	Power-operated equipment: tractor, pump, harvest and post-harvest equipment (may be manufactured in a few developing countries).

ANNEX 2

CATEGORIES OF IRRIGATION EQUIPMENT AND ACCESSORIES
(FOR DIFFERENT LEVELS OF PRODUCTION AND SIZE OF
APPLICATION, IN SEQUENCE OF TECHNOLOGICAL COMPLEXITY)

Category A products

1. Hand pumps
   (a) reciprocating type
   (b) washer chain type
2. Pedal-operated reciprocating pumps
3. Bellows pumps
4. Animal drawn water wheels
5. Windmills
6. Hydraulic ram
7. Sheet metal products (troughs, buckets, pots, pans, taps, accessories)
8. Hand tools for earth moving and handling
9. Water storage tanks (cisterns) of all types, stationary and mobile
10. Wheelbarrows, crowbars, metallic baskets, etc.

Category B products

1. Windmill-driven pumps

2. Submersible pumps

3. Mechanical water lifts

4. Hydrants

5. Couplings

6. Rotating sprinklers

7. Rainers

8. Fertilizer infusion apparatus for irrigation installations

9. Locks and mechanisms

Category C products

1. Panels of all types

2. Instruments

3. Portable installation for trickle irrigation

4. Centrifugal pumps (engine-operated, electrical motor-operated, PTOs)

5. Pumping stations

6. Stationary electric pumping sets

7. Mobile engine-driven pumping sets

8. Maintenance, repair and spare parts production for earth-moving equipment, graders, scrapers, dredgers, excavators, bulldozers.

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INTERNATIONAL STRATEGY TO STIMULATE THE AGRICULTURAL MACHINERY INDUSTRY AND INTENSIFY AGRICULTURAL MECHANIZATION IN DEVELOPING COUNTRIES *

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WE THE PEOPLES OF THE UNITED NATIONS DETERMINED

to promote social progress and better standard of life and larger freedoms.

AND FOR THESE ENDS

to employ international machinery for the promotion of the economic and social advancement of all peoples.

From the Charter of the United Nations

In fulfilling its mandate, UNIDO

provides assistance to developing countries, particularly in expanding, modernizing and operating their industries, including agro-based or agro-related and basic industries.

From the functions of UNIDO

* * * * * * * *

The Consultant wishes to express his deepest gratitude to the officials, specialists and other staff of the United Nations Industrial Development Organization in enabling him to undertake the present work and warm appreciation for their assistance in carrying out the work to the officials, specialists and other staff of the organizations, institutions and centres in the various countries who collaborated with him, providing information, showing their results and offering their personal experience.

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CHAPTER 1

INTRODUCTION

1. The main objective of this study is to outline an international strategy to provide a stimulus to the agricultural machinery industry and to lay the foundations of increased agricultural mechanization, in accordance with the needs and requirements of developing countries.

2. To this end, from 29 April to 12 July 1985, a considerable number of organizations, institutions and centres in eight European, African and Latin American countries were visited. The aspects to be analysed in each country had previously been selected in order to obtain the fullest possible information to provide a generalized regional and global view of the current position and future prospects in this field.

3. During the tour it was possible to assess these aspects in practice, drawing in addition on the effective experience of the officials and specialists contacted. Furthermore, a considerable volume of documentation was assembled and this proved most valuable in complementing the work and further supporting its basis, conclusions and recommendations, as can be appreciated from the bibliographic review.

4. In this study, the fundamental priority is given to developing national industry, using indigenous resources, focusing primarily on small- and medium-scale enterprises, single or multi-purpose, with the capacity to produce agricultural tools, equipment and machinery in quantities and to specifications appropriate to the conditions in each country, while at the same time capable of being adapted in progressive stages to assimilate more complex technological processes.

5. Emphasis is placed on creating conditions in agriculture which will permit widespread use of mechanization, both in small- and medium-sized farms as well as gradually opening the way for farmers' associations and co-operatives which, from a technical and economic point of view, may permit agricultural machinery to be more widely introduced and more efficiently used.

6. The role to be played by Governments in both aspects is anotner of the points which is highlighted together with the importance of co-operation between States to pool their efforts and solve the difficulties which actually arise when action is undertaken on this scale.

7. We believe that this final report simply and precisely provides the necessary facts to enable the United Nations Industrial Development Organization, through its own organs and with the support of other international, regional and subregional organizations and those of member States, to set in motion a universal movement resulting in the progressive and continuing expansion required in the manufacture of agricultural machinery and its introduction into agriculture, and thus to contribute, albeit modestly, to an improvement in economic and nutritional standards in developing countries, a task which can be postponed no longer.

CHAPTER 2

BACKGROUND AND BIBLIOGRAPHIC ANALYSIS

2.1 Background

8. At the First Consultation on the Agricultural Machinery Industry, held in Stresa (Italy) in October 1979, the Secretariat of UNIDO, in introducing the subject of the formulation of a strategy for the agricultural machinery industry in developing countries, stated that "this should be based on an assessment of the overall machinery requirements for agriculture and of what should be produced locally. The strategy depended on the agricultural mechanization policy of each country, which had links with the international situation in the agricultural mechanization field. It was characterized by the imbalance in consumption, production and international trade between industrialized and developing countries, since the latter used only 12 per cent of modern agricultural machinery, produced less than 6 per cent of world output and exported only 1 per cent of international trade." 3/

9. In the same Consultation, in discussions on the formulation of a strategy at national level, it was stated that "the starting point for the strategy should be the collection of data on types of crops, size of plots, the current status of mechanization, topographic and climatic characteristics, the land tenure system, the socio-psychological characteristics of the local population, their current levels of income, the significance and potentialities of local craftsmen, the industrial infrastructure etc. The next step would be to formulate the strategy within the framework of national policies and objectives on economic and social development with the assistance of the data mentioned above. In that connection, a number of important factors were stressed, such as the recognition of the importance of the evolution of agricultural mechanization, bearing in mind the need to pay due regard to agronomic and socio-economic considerations, with special attention to industrial labour, women and the poorest sector in the agricultural community." 4/

10. In this connection the Second Consultation on the agricultural machinery industry states, in one of its conclusions, that "the agricultural machinery industry cannot be considered in isolation; rather, it should be considered as a key factor in both agricultural and industrial development." 5/ Another conclusion recognizes "the validity and applicability of the concept of multi-product production units for the manufacture of agricultural and capital goods equipment in developing countries. In areas where such units already exist, better capacity utilization is possible by adding new products, even if they are needed in other sectors, that suit the available production facilities." 6/

3/ UNIDO, Report of the First Consultation on the Agricultural Machinery Industry, Stresa, Italy, ID/239 (ID/WG.307/9/Rev.1), 1979, page 10, paragraph 9.

4/ Ibid., page 11, paragraph 12.

5/ UNIDO, Report of the Second Consultation on the Agricultural Machinery Industry, Vienna, Austria, ID-307 (ID/WG.400/8/Rev.1), 1983, page 5, paragraph 7.

6/ Ibid., page 6, paragraph 10.

11. The Second Consultation also recommends the establishment, under the auspices of UNIDO, of a group of experts made up on the basis of equitable geographical distribution, taking into account the need for interested parties, including Governments, manufacturers and users of agricultural machinery, to be represented, and in order to perform the following tasks: 7/

"(a) To carry out a precise assessment, on a selective basis, of the needs in terms of products and technology in purchasing countries and of the industrial capacity available in supplying countries;

(b) To establish a framework for industrial co-operation in the sphere of agricultural machinery to facilitate the establishment of contacts and to improve the effectiveness of such co-operation, emphasizing in particular the mobilization of small- and medium-scale enterprises;

(c) To investigate the possibility of establishing further regional networks to provide access to information available from various research centres related to agricultural machinery, design and production know-how. Interregional co-operation should be encouraged."

12. It further recommends that UNIDO should convoke a regional consultation in Latin America and, if possible, in Asia in order to study the requirements of the agricultural machinery industry in those areas in order to promote regional and subregional co-operation, 8/ and should give due consideration to the problems of Africa in line with the recommendations of the Regional Consultation on the Agricultural Machinery Industry in Africa. The results achieved in relation to increased food production and increased industrialization should be reported at a subsequent Consultation. 9/

13. The aspects discussed in issue 1 of that Consultation are of great importance: 10/

"(a) The influence of the strategies of dominant firms in the area of international co-operation;

(b) The relationship between the evolution of models of agricultural mechanization and the future of the agricultural machinery industry;

(c) The determinant role of States for the future of international co-operation;

(d) The necessary renewal of the agricultural machinery industry considering the needs of countries and the most needy farmers."

14. On that basis, four main points were proposed for discussion by the participants: 11/

7/ Ibid., pages 6-7, paragraph 12.

8/ Ibid., page 7, paragraph 13.

9/ Ibid., page 7, paragraph 15.

10/ Ibid., page 16, paragraph 50.

11/ Ibid., pages 16-17, paragraph 51.

"(a) The influence of the strategies of enterprises on aspects of international and regional co-operation;

(b) The effect of the evolution of agricultural policies and types of mechanization on the agricultural machinery industry and the opening of international co-operation to new partners, in particular small- and medium-scale enterprises;

(c) The responsibilities of the supplying and receiving countries in the development of mutually beneficial industrial co-operation, which would open new horizons for world industry and for the production of agricultural equipment in developing countries;

(d) The reorientation and priority actions of the international community and the development of aid for the promotion of mechanisms adapted to the needs of agricultural mechanization and rural development in developing countries."

15. With regard to the assembly of agricultural equipment, according to the document prepared by the Secretariat of UNIDO for the Second Consulation on the Agricultural Machinery Industry, the following limitations apply: 12/

"- It does not constitute a transfer of technology, although it may be a first step;

- It does not permit the development of local technical and technological capacities, though it may set such development in train;

- It generates only little value added;

- In comparison with tne purchase of fully assembled products, importing equipment assembly kits for local assembly does not always secure any substantial foreign exchange savings; often the prices charged for equipment kits result in a cost price for locally assembled products which is higher than tne cost of importing the same products fully assembled."

16. Nevertheless, in the general remarks, it is suggested that "in developing manufacture, the objective to be attained is to ensure some degree of autonomy for the country or the homogeneous geopolitical grouping in question. The course to be followed depends on the particular conditions of each country, that is to say, its degree of industrialization, the existence or absence of an industrial fabric, market size, the availability of finance, human resources and the need for tne further processing of local raw material," 13/ and it goes on to state that "the manufacture of a complex product, such as a tractor, might be envisaged within tne framework of an industrialization plan extending over a long period. Intermediate phases of varying length could then be identified, ranging from the simplest to the most complicated processes; assembly, pressing, machining, heat treatment, forging and other operations."

12/ UNIDO Secretariat, Items to be Included in Model Contracts for the Import, Assembly and Manufacture of the Agricultural Equipment including Training: Model Licensing Agreement. Second Consultation on the Agricultural Machinery Industry, Vienna, Austria, ID/WG.400/2, 1985, paragraph 35.

13/ Ibid., page 40.

17. With regard to training, it is emphasized that it is "an essential ingredient for the successful establishment and operation of industrial production units. This is particularly true for the developing countries, where there is a serious lack of trained personnel. Hence, special attention should be devoted to training, as regards both the technological routes directly related to production and the support activities." 14/

18. The fundamental elements of contracts for agricultural machinery are set out in detail in the document: Guidelines to International Contracts for the Acquisition, Assembly and Manufacture of Agricultural Machinery and Spare Parts Therefor, submitted to the Expert Group Meeting. It contains matters of great concern to the purchaser from a developing country which must be kept very much in mind, such as for example: 15/ "a purchaser from a developing country may not have available locally the information necessary to enable him to judge the quality of the agricultural machinery which he proposes to buy. In addition, a novice in the acquisition of that machinery who has little or no technical expertise to draw upon cannot know what particular machinery will best suit the soil and other conditions prevailing in his country". The question of the suitability of machinery for local conditions is of particular importance to the purchaser from a developing country. In order to ensure that this problem is adequately covered in the contract, articles relating to both suitability and quality must be the subject of separate clauses.

19. There is a close relationship between the agricultural machinery industry and the capital goods industry, with the same problems in both being observed in developing countries, as can be seen from the similarities between the First and Second Consultations on the latter branch in comparison with those on the agricultural machinery industry which have already been analysed. The First Consultation on the Capital Goods Industry, held in Brussels (Belgium), from 21 to 25 September 1981 proposed, as its first conclusion, "the necessity to increase the production of capital goods in developing countries, which will correct a fundamental disequilibrium between developed and developing countries." 16/

20. It goes on to state that, "in order to increase the production of capital goods in the developing countries and to promote industrial co-operation, it is recommended that UNIDO should 17/

(a) Give priority to assisting those developing countries without or with only embrionic capital goods industries, which are in the majority, through technical assistance within the framework of the United Nations system;

14/ Ibid., page 65.

15/ R. Fitz Gerald, (UNIDO Consultant), Guidelines to International Contracts for the Acquisition, Assembly and Manufacture of Agricultural Machinery and Spare Parts Therefor. Expert Group Meeting, Vienna, Austria, ID/WG.443/1, 1985, pages 6-7, paragraph 21.

16/ UNIDO, Report of the First Consultation on the Capital Goods Industry, Brussels, Belgium, ID/276 (ID/WG.342/8/Rev.1), 1981, page 4, paragraph 1.

17/ Ibid., pages 4-5, paragrah 4.

(b) Assist developing countries to plan the long-term development of the industrial sector;

(c) Make information available to developing countries on the technological alternative, their availability, results, costs and commercial conditions for their acquisiton;

(d) Establish, in co-operation with the International Labour Organisation, training profiles for the various levels of technological complexity, and examine possible changes to be made to existing programmes;

(e) Assist in the strengthening of co-operation between developing countries through the organization of an exchange of information between these countries in capital goods, technologies and engineering services."

21. Included in the documents prepared for the Second Consultation on the Capital Goods Industry, with special reference to energy-related technology and equipment, is the one entitled Conditions of Entry into the Capital Goods Sector and Integrated Manufacture, prepared by the UNIDO Secretariat, which states that "the studies carried out for the First Consultation on the Capital Goods Industry and additional work done for the Second Consultation have clearly shown that the development of the capital goods industry in a developing country requires complete dedication and demonstration of will on the part of the Government." 18/

22. It immediately adds that "the development of the capital goods industry should be linked with the goals of economic development of a developing country and sets out some of the possible orientations: 19/

- The development of agriculture and agro-based industries to ensure food for the population and to implement rural development programmes;
- Development of those specific subsectors of the capital goods industry which would manufacture equipment for the dominant sectors of the economy;
- Import substitution being adopted as the main industrial targets;
- Predominantly export oriented industrial development including the capital goods industry;
- Creation of a technical infrastructure as a prerequisite for a stable development with relatively high rates of growth and specialization in the capital goods industry."

23. Among the documents presented to the Second Consultation on the Agricultural Machinery Industry, is the one on the Agricultural Machinery Industry in the 1980s, 20/ which in its first part refers to the crisis in this industry, pointing

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18/ UNIDO Secretariat, Conditions of Entry to the Capital Goods Sector, background document to issue 1, Second Consultation on the Capital Goods Industry, Stockholm, Sweden, ID/WG.442/3, 1985, page 66, paragraph 102.

19/ Ibid., page 66, paragraph 103.

20/ Bye, P. and Chanaron, J. J., UNIDO, The Agricultural Machinery Industry in the 1980s. Factors for International Co-operation, Second Consultation on the Agricultural Machinery Industry, Vienna, Austria, ID/WG.400/1, 1983, page 2, paragraph 1.

out that "for nearly ten years it has been going through a major crisis. Although this crisis is general, the forms it takes differ according to economic regions, the amount of development, the systems of agricultural production and the large categories of machines and equipment associated with them." It goes on to say that "the last five years have been marked by a sharpening of the difficulties in the agricultural machinery industry which first appeared at the beginning of the 1970s in the industrialized countries."

24. The activity of the largest world producers of tractors and combined harvesters has declined, according to the document, which adds that "sales in the developed countries have fallen significantly. In the United States of America sales of tractors and combined harvesters (expressed in numbers of units) fell by a half between 1978 and 1982. Similar findings occur in the material for the Second Consultation on the Agricultural Machinery Industry: Prospects for International Co-operation prepared by the UNIDO Secretariat." 21/

25. In the chapter on factors to increase international industrial co-operation, dealing with the agricultural machinery industry in the 1980s, it deals with the direct participation of the State in negotiations, specifying that it is a way to ensure the consistency of the options of agricultural and industrial policies and social and economic development. The role of the State is equally decisive in the financial aspect of negotiation. 22/

26. One of the aspects most frequently discussed today, with a view to extending the range of options for manufacturing agricultural machinery, is integration with the manufacture of other products, in other words, multi-purpose or multi-production units. In this connection the points contained in document No. 11 prepared by the Secretariat of UNIDO for the Second Consultation on the Agricultural Machinery Industry are important. This document points out that "in order to make such production economically sound, it is essential to consider agricultural machinery as an integral part of engineering and capital goods manufacturing programmes, to diversify products and introduce a broad range of manufacture." 23/

27. It goes on to suggest that "combined production could be established in multi-product units. These units have distinct advantages: they facilitate the learning of a higher degree of diversified production skills; enable the fullest use of available industrial infrastructure consisting of basic facilities such as foundries, forges, heat treatment and encourage the development of a well-balanced technological infrastructure in terms of design, engineering services and training. For many countries, multi-product production units are the only way to develop their infrastructure, not only to produce agricultural machinery, but also to accelerate the development of the engineering and capital goods sectors."

21/ UNIDO Secretariat, the World Agricultural Machinery Industry: Prospects for International Co-operation, Issue Paper No. 1. Second Consultation on the Agricultural Machinery Industry, Vienna, Austria, ID/WG.400/3, 1983, page 5, paragraph 5.

22/ Op. cit. 20/, page 50, paragraph 33.

23/ UNIDO Secretariat, Integrated Manufacture of Agricultural Machinery and Capital Goods, Issue Paper No. 11. Second Consultation on the Agricultural Machinery Industry, Vienna, Austria, ID/WG.400/5, page 1, paragraph 3.

2.2 Bibliographic analysis

28. After reviewing the basic documents which make up the background and provide a foundation for this work, we come to the conclusion that a great number of aspects of this field have been dealt with, including aspects of the current situation and future outlook, with an analysis of the factors which are influencing or will influence them in the future. A great many action programmes have been implemented, several are currently in progress and future projects have been outlined.

29. We thus consider it appropriate to delve a little deeper into the records of these actions, which present the problem from various angles and situate it firmly in the objective reality of today's world. We summarize below data extracted from some of the documents we studied which serve to make us aware of what has been done and reflect on what remains to be done, and which can at the same time be useful, in a small way, in connection with anything related to this field.

2.2.1 The agricultural machinery industry

30. The FAO Panel of Experts on agricultural mechanization in 1983 recommended that FAO in conjunction with UNIDO should encourage Governments to stimulate local production of adequate equipment, including facilities for maintenance and repair 24/ and, referring to small-scale production, stated that with regard to the needs of small farms, there is a great potential for multi-purpose rural workshops to fill the vacuum between artisanal production and centralized industry. 25/

31. As early as 1979, in the book World Industry since 1960: Progress and Prospects, it is specifically stated that "the development of an appropriate indigenous technology based on available domestic resources is closely related to self-reliance and education," and it continues by declaring that "most developing countries now explicitly include technological development among the main long-term objectives of industrialization." 26/

32. It is clear that for the study, organization, implementation and start-up of these plans to be effective, it is necessary to outline a policy eliminating all those obstacles of an internal nature which are present in most countries and to achieve unifying links to combat external influences.

33. The chart on utilization of installed capacity in the report on the project MEX/82-015 shows that of the five agricultural machinery manufacturing plants in Mexico, only one exceeded 60 per cent utilization of installed capacity in 1982, and in three of them there were reductions compared with 1979. 27/ The capital goods sector in this country makes mention of projected production of 20,000

24/ Tillage Practice on Small Farms in the Tropics. FAO Panel of Experts on Agricultural Mechanization. Report of the Fifth Session, Rome, Italy, 1983, page 6.

25/ Ibid., Annex XI, page 2.

26/ World Industry since 1960: Progress and Prospects. Special issue of the Industrial Development Survey for the Third General Conference of UNIDO, ID/CONF.4/2 (ID/229), New York, 1979, page 142.

27/ The Evolution, Current Situation and Projected Supply and Demand for Agricultural Tractors in Mexico. Project SPP.-UNIDO-UNDP, Mex/82-015, Mexico, 1983, page 23.

tractors in 1981 and 35,000 in 1985, when the installed capacity at the time when the projection was made (1979) was already 44,000 tractors per year. 28/

34. A similar pattern is shown by the national capital goods manufacturing sector in Ecuador in relation to its productive capacity, recording that 67.60 per cent of enterprises in the sector use less than 61 per cent of their installed capacity and only 9.86 per cent use more than 80 per cent. 29/ Analogous situations can be seen in the agro-food industries: for example, at the Symposium on Food Industries in Argentina it was stated, in the general context of the fruit and vegetable canning industry, that the sector had a structural capacity and potential resources which would enable it to satisfy the domestic market and at the same time export markets which it had traditionally supplied. It its present situation and in relation to the economic situation, it appears excessive for the domestic market and its export operations have been strangled. 30/

35. In the final report of project CGID/UNIDO Mex/82/016, it is pointed out that, as a result of inadequate forecasts of the market, requirements for product quality, presentation, lack of standardized production and quality of raw materials, there are bottlenecks in production processes, leading to underutilized installed capacity and low product quality. 31/ In the same project, Mex/82/016 in another of its documents 32/ it is said that the problems afflicting the cycle from primary production of raw materials to distribution of final products causes technical inefficiences, including low utilization of installed capacity in the agro-industrial stock.

36. Marketing opportunities are a factor which affect the low utilization of installed capacity. In the document Conditions of Access to the Capital Goods Sector and Integrated Manufacture 33/ it is stated that a small developed market economy farm requires three years to pay for a tractor in terms of its cereal yield, while another in a developing market economy requires 15 years or five times longer. These data which relate to 1979 show a steadily increasing disproportion due to the rise in the cost of machinery and the fall in prices of agricultural products in general.

37. The foregoing suggests that there is an inescapable need for Governments to intervene to stabilize the prices since, with certain differences, these phenomena appear in most countries with the fatal result of depressing agricultural production particularly in small- and medium-sized farms.

28/ The Supply of Capital Goods in Mexico. NAFINSA-UNIDO Joint Capital Goods Project, Capital Goods Sector Monographs No. 1, Mexico 1979, page 27.

29/ The National Capital Goods Manufacturing Sector. CEBCA, Quito, Ecuador, 1982, page 18.

30/ Symposium on the food industries, Argentina. Results and recommendations of the project, AG/DP/ARG/78/013; Terminal report, UNDP/FAO, 1980, page 7.

31/ Specific recommendations on the financing and economic incentive to promote and develop integrated rural agro-industry. Project: CGID/UNIDO Mex/82/016, Terminal report, Mexico, 1985, page 53.

32/ Promotion and development of integrated agro-industries. Project SAR/UNIDO Mex/82/016, UNDP, Mexico, 1985, page 27.

33/ Op. cit. 18/, page 78, paragraph 151.

38. Thus, Sara Mangiamarchi, in a study of the wholesale price index for goods imported into Equador, 34/ shows that there was an increase in prices of machinery and equipment for agriculture in which the index almost doubled between 1974 and 1980 and despite the fact that prices for agricultural products basically for export, such as coffee and cacao, declined. Wheeled tractors, in the same country, showed a substantial increase reaching the order of 320 per cent to 360 per cent between 1979 and 1983. 35/

39. The study of tractor supply and demand in Mexico 36/ also reflects the fact that the main causes of the sharp decline in demand, a fall of approximately 49.9 per cent compared with 1982 (this year, it showed a further fall of 20.3 per cent compared with 1981) were mainly: the dramatic rise in prices of machinery, increased demand for guarantees and interest for aid loans and reduced availability of resources among farmers due to the poor farming results in 1982 and the insufficient rise in guaranteed prices for agricultural products compared with the rise in production costs. Cifuentes, in his Analysis of the State of the Market for Agricultural Tractors 1983-1984 and Projections to 1990, sets the increase in the price of tractors between sales concluded in December 1983 and the first quarter of 1984 at 41.7 per cent. 37/

40. In the light of the foregoing and what follows, it is important that every country, using its own resources and advised by the appropriate international organization, should carry out a review of agricultural machinery requirements and capacity for producing or acquiring them.

41. In order to achieve better utilization of capacity and to increase industrial production it is important to give consideration to multi-purpose units. For Gürkök, it is self-evident that problems of agricultural machinery production must be discussed in the context of agricultural organization, agricultural mechanization and the industrial strategy of a given country. The objective here is to identify possibilities of an integrated approach to link agricultural machinery and capital goods industries to achieve better utilization of the scarce resources of a developing country. 38/

42. There is a great deal of analysis relating to flexibility in industrial plants and their ability to switch between production of a range of products, so that, for example, the document Mexico: Hollow Vessel Manufacture in 1984 states that possessing a considerable degree of flexibility allows versatile plants to avoid the crisis, thanks to their ability to rapidly change product lines during a period of recession. Nevertheless this can involve high costs, since the plant is obliged

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34/ Mangiamarchi, Sara, (FAO consultant), Preparatory document for the follow-up to the World Conference on Agrarian Reform and Rural Development. Case of Equador, FAO, 1983, pages 47-48.

35/ Profile of the domestic market in agricultural wheeled tractors. Industrial Development Centre of Equador, Quito, 1984, page 37.

36/ Op. cit. 27/, page 36.

37/ Cifuentes, E., (National Consultant), Analysis of the State of the Market in Agricultural Tractors 1983-1984 and Projections to 1990. Project UNIDO-Mex/82/015, SPP-UNIDO, Mexico, 1984, page 17.

38/ Gürkök, C., The Integrated Manufacture of Agricultural Machinery and Capital Goods: Multi-purpose Production Routes, 1984, page 24, paragraph 26.

to maintain a considerable investment in equipment, technology, specialized personnel etc. For this reason, it is relevant to carry out a careful analysis of costs and benefits before taking a decision on flexibility in a new plant. 39/ We consider that the appropriate line to follow would be adaptation of existing plants to cover requirements in the first stage of development and to build new factories for specific purposes.

43. Wanjun, discussing the establishment of a multi-purpose agricultural machinery factory, on the specific point of the feasibility study, says that past experience has shown that the technical and economic feasibility study of a factory, regardless of its size, prior to the design stage, is very important to its successful installation and operation. Qualified experts (engineers, agronomists, economists) must together go into the field to investigate basic conditions, such as: specific needs of farmers, category and volume of products, purchasing power and marketing potential, local resources, infrastructures, particularly that for transformation, available sources of materials, energy, purchase of parts or components and economic analysis of the factory. 40/

44. Analysis of the Common Strategies for the Countries in Group C, that is those which have a small to medium-sized market, very small to small production capacity and very small to small negotiating power, led in the Second Consultation on the Capital Goods Industry 41/ to proposals for approaches to be adopted and stages through which the capital goods industry, including agricultural machinery and agro-industry, must pass in these conditions.

45. Another route to be considered is assembly, where there are examples generally involving enterprises from developed countries established in developing countries and in some cases mixed enterprises with the participation of the host country included in the co-operation agreements. An example that we can cite is the Empresa Estatal Siderúrgica Nacional de México which assembles a tractor of Soviet manufacture under the name SIDENA, with a level of national integration of 16 per cent. 42/

46. Training and technology were recognized as key elements in the development of the capital goods industry in the First Consultation on this sector. In the report of the corresponding working group it was stated that training must be a major component of industrial agreements 43/ and it was considered important to set up or strengthen training institutions in developing countries, at national or subregional level to promote the appropriate technical skills. Moreover, from an information standpoint, the Second Regional Workshop on Farm Machinery Testing

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39/ Mexico: Hollow Vessel Manufacture in 1984. NAFINSA-UNIDO joint project on capital goods, sectoral monographs on capital goods No. 9, Mexico, 1984, page 85.

40/ Wanjun, W., (UNIDO Consultant), Establishment of Multi-purpose Agricultural Machinery Plant. UNIDO, Section for Economic Co-operation Among Developing Countries, page 5.

41/ Op. cit. 18/, pages 60-62, paragraphs 108-112.

42/ Op. cit. 27/, page 39.

43/ Op. cit. 16/, page 18, paragraph 51.

Procedures recommends that there should be effective international exchange of test results through recognition of agreed procedures and publication of test results in standard formats. 44/

2.2.2 Agriculture and the situation in rural areas

47. Agriculture in developing countries is going through a profound crisis which is leading to an untenable situation in the rural environment in most of these countries. It is enough to point out that these countries import some 80 million tons of food and, according to Ramaswamy, 45/ it is expected that this will reach 100 to 150 million tons by the year 2000. The form of land tenure is a particularly influential factor in this situation since, as Gómez states, 46/ apart from the inappropriate use of land caused by subdivision of plots, it also becomes impossible in some cases and in others difficult or more expensive to introduce technical advances such as electrification, mechanization, irrigation, artificial insemination, agricultural aviation and other new developments not only technical but those related to cultivation and the standard of living of the farmer and his family.

48. CENDES 47/ indicates that according to the 1975 Farm Census in Ecuador, 80 per cent of farms had an area of between 0 and 10 hectares representing only 15 per cent of the total area under cultivation while on the other hand 43 per cent was included in the 1.9 per cent of farms with an area greater than 100 hectares each. In Brazil in 1979, according to the document prepared for the World Conference on Agrarian Reform and Rural Development, quoted in the final report of the project ES:DP/BRA/77/002, more than 70 per cent of land units fell into the category of small holdings, which totalled less than 12 per cent of the total area of farm land; on the other hand, large farms constituted little more than a quarter of the total number of enterprises but occupied about 80 per cent of the total area. 48/

49. This problem is becoming more and more acute in developing countries and also affects developed countries, for two fundamental reasons which have been analysed separately: the inheritance laws under which the original family nucleus is constantly subdivided into many nuclei which occupy progressively smaller and smaller plots; and the social injustice whereby large estates, either through economic pressure, deception or force, progressively absorb small farms.

44/ Second Regional Workshop on Farm Machinery Testing Procedures. Food Production Rural Development Division, Commonwealth Secretariat, Malawi, 1982, page 9.

45/ Ramaswamy, N. S., Animal Energy in Developing Countries, with special reference to Asia. Report of the FAO Expert Consultation on the Appropriate Use of Animal Energy in Agriculture in Africa and Asia, FAO, Rome, 1982, page 31.

46/ Gómez, O., De la Finca Individual a la Cooperativa Agropecuaria. Editora Política, La Habana, Cuba, 1983, page 67.

47/ Op. cit. 35/, page 31.

48/ Agricultural Planning, Brazil. Results and recommendations of project ES:DP/BRA/77/002. Terminal report, UNDP/FAO, Rome, 1980, page 13.

50. 72 per cent of farm production units (FPU) which have been established and are covered by the project UNDP/FAO/ECU/79/007, are in the range of 0.1 to 3 hectares representing 30 per cent of the total area. 49/ Ramaswamy states that in India there are more than 50 million small and marginal farmers with holdings of less than 3 hectares 50/ and if we make some simple calculations using the data published by the 13th FAO Regional Conference for Africa, 51/ we find that the average arable land per head for rural inhabitants for 51 countries in the region is 0.5 hectares, despite the fact that the total area per capita is 16.17 hectares for the whole population, and this is due to two factors: 64.42 per cent of the population of the region lives in the country and only 5.23 per cent of the land area is arable. For Gómez Jasso the type of land holding is another factor exercising a decisive influence on the acquisition of machinery and therefore on mechanization since it becomes a matter of investment which must be economically justifiable. 52/

51. Associative forms of production and the establishment of co-operatives must be at the forefront of consideration when it comes to stimulating agriculture in developing countries. Forms of co-operatives in the world have developed various structures and organizations in different countries and regions for many years, and the report on the Expert Consultation on the Development of Agrarian Structures in Latin America in 1973, 53/ gives three forms of associative property for production:

(a) Simple association with contributions of land, capital and labour. This is in turn subdivided into four types.

(b) With contributions based on land, capital and labour, with share participation; this can be divided into five types.

(c) Forms of ownership which include: State ownership and public corporations.

52. The same document goes on to define each of these forms and relates them to countries where they have been developing, each with its own characteristics. Covering the period from then until the present time, we can say that in the developing countries there have been advances in some cases, stagnation in others and a regression in not a few, a subject which would be extensive to examine in detail. The Symposium on Food Industries in Argentina, in one of its specific recommendations, suggests that another aspect which must be considered is

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49/ Integrated rural development project; Tanicuchi, Toacaso, Pastocalle. Secretariat of Integrated Rural Development, Ecuador, project UNDP/FAO/ECU/79/007, Volume 1, 1983, page 78.

50/ Op. cit. 45/, page 29.

51/ Trained Agricultural Manpower Assessment in Africa. Prepared for the 13th FAO Regional Conference for Africa, Harare, Zimbabwe, FAO, Rome, 1984, page 6.

52/ Gómez, R., Achievements and Contributions of Research into Agricultural Engineering and Mechanizations. National Agricultural Research Institute (INIA), Secretariat for Agriculture and Water Resources (SARH), Mexico, 1983, page 17.

53/ Development of Agrarian Structures in Latin America. Report of the Expert Consultation, FAO-German Foundation for International Development, Berlin-Tegel, 1973, page 8.

encouraging small proprietors to form co-operatives so that they can obtain access to machinery and cultivation methods which may make their farming genuinely more economic. 54/

53. In Cuba, to provide farmers and co-operatives with the inputs required for their productive activities, such as soil preparation services, bulldozing, repair of machinery and implements, the Ministries of Agriculture and the Sugar Industry have a network of stores and workshops distributed throughout rural zones of the country. Each of the "geographical districts" as they are usually called, also has a fleet of tractors and implements to provide services to those co-operatives and farmers who have previously contracted for them. In the future, in line with the growth of co-operatives and the consequent decline in the number of individual farmers, these installations and resources will be progressively transferred to farm production co-operatives (FPC). 55/

54. Another aspect which this report considers and which is of great importance in co-operatives is the involvement of women and young people. It mentions that 27 per cent of the members of co-operatives are women enjoying the same conditions and rights as men and 16.3 per cent of co-operative members are young people who have quite consciously been able to make themselves an unprecedented mobilization factor. 56/ Many other reports refer to women and young people in country areas in other parts of the world. The same document states that the creation of co-operatives has permitted greater utilization and greater concentration of resources, allowing the application of adequate development criteria and making more rational use of all the available means for the application of modern techniques, resulting in a consequent increase in production and productivity.

55. As early as 1967 Lönnemark was speaking of co-operatives for the acquisition of machinery when he said that the co-operative society offers a form of joint ownership of machinery through a relatively small subscription from each member to the total investment, and only a part of this contribution may be required in cash. The society as a whole owns machines, lends money and carries on its business with the sole aim of benefiting the members. It would seem that the co-operative society offers a sensible way of applying the concept of mutual assistance. 57/ The author goes on to point out that in many developing countries much effort is exerted to create multi-purpose agricultural co-operative societies. This is a natural movement in countries where sufficient competition among private undertakings is lacking. In some countries these co-operatives are intended also for introducing farm machinery or for taking over a government hire service.

54/ Op. cit. 30/, page 9.

55/ Report on progress in the Agrarian Reform and Rural Development Sector in the Republic of Cuba. Ministry of Agriculture, La Habana, 1983, page 29.

56/ Ibid., pages XIV-XV.

57/ Lönnemark, H., (FAO consultant), Multifarm use of agricultural machinery. FAO: agricultural development paper No. 85, Rome, 1967, page 51.

56. Many projects concluded in recent years deal directly or indirectly and from a variety of viewpoints with the question of association and forms of co-operative in rural areas, among which we may mention: Rural Sociology in Lesotho, in which land owners are encouraged to amalgamate their land for joint cultivation using modern techniques; 58/ the Agricultural Production Credit and Co-operative Scheme in Nigeria; 59/ Assistance to Co-operative Development and Marketing, the Philippines, which describes how for the first time farmers were organized at village level into associations known as Samanhang Nayon. These associations or pre-co-operatives provided a means of channelling basic support services to farmers. 60/

57. The formation of model agricultural co-operatives in the Lao Peoples Democratic Republic had a primary objective of selecting, from all existing co-operatives, ten model co-operatives, to establish an effective management and marketing structure for agricultural co-operatives. 61/ The Programme of Integrated Technical Assistance to Selected Settlements in Uruguay, states, among specific measures, that to accelerate and facilitate the process of convincing producers of the advantages of technology, at least one demonstration farm will have to be set up in each colony, using adapted technology which is simple and accessible, including production cost analysis the results of which will be widely published. 62/

58. Another of the problems which is strongly felt in some areas is the case of refugees, displaced persons and victims of natural disasters; that is why the Special Programme of Action for Improvement of the Food Situation and Rehabilitation of Agriculture in Africa points to the need to take concrete measures at national and regional level to deal with the general situation, in order to prevent new large-scale population movements and ensure that refugees, displaced persons and victims of natural calamities can participate in socio-economic development activities in their countries of origin. 63/

58/ Rural Sociologist, Lesotho. Project Finding and Recommendations, ES:DP/LES/71/011, Terminal Report, UNDP/FAO, Rome, 1979, pages 13-14.

59/ Agricultural Production Credit and Co-operative Scheme Plateau State, Nigeria. Project Finding and Recommendations, AG:DP/NIR/75/015, Terminal Report, UNDP/FAO, Rome, 1981.

60/ Assistance to Co-operative Development and Marketing, The Philippines. Project Finding and Recommendations, AG:DP/PHI/76/001, Terminal Report, UNDP/FAO, Rome, 1981, page 4.

61/ Formation of model agricultural co-operatives, Lao People's Democratic Republic. Conclusions and recommendations of the project, ES:DP/LAO/80/006. Terminal report, UNDP/FAO, Rome, 1982, page 2.

62/ Programme of Integrated Technical Assistance to Selected Settlements by the National Settlement Institute, Uruguay. Results and recommendations of the project, Terminal report, UNDP/FAO, Rome, 1983, page 17.

63/ Special Programme of Action for Improvement of the Food Situation and Rehabilitation of Agriculture in Africa. Second Session of the Steering Committee for the Twenty-First Assembly of Heads of State and Government Meeting of Experts, OAU, Addis Ababa, Ethiopia, 1985, page 13, paragraph 29.

59. The world as a whole cannot turn its back on this situation and must contribute its firm support, particularly industrialized countries which must provide the necessary resources, in particular those countries which until recently were the colonial powers in these areas.

60. One of the measures which can make the greatest contribution to the development of small- and medium-scale industrial and agricultural enterprises is credit, which when it is granted in a form appropriate to the characteristics of such enterprises, makes the manufacture of machinery, equipment and replacement parts viable and facilitates the mechanization of agriculture. Lönnemark many years ago stated that the usual practice of buying farm machinery on an instalment basis can be expensive, and the credit provided may be of too short a term. Therefore, the provision of satisfactory medium- and long-term credit is an effective means for promoting agricultural mechanization. 64/

61. With reference to monetary and credit policies, in the document World Industry since 1960: Progress and Prospects, it is stated that "international lending institutions in the past helped countries to subsidize long-term loans, again accommodating priveleged manufacturers who often included foreign investors. With limited savings and subsidized funds, official credit had to be rationed. Inevitably, large firms were the recipients, and small firms had to borrow in street markets where interest rates were two to three times the official rates ...". 65/ In the final document of the project Promotion and Development of Integrated Agro-Industry in Mexico it is pointed out that "the criteria for granting credit are oriented more towards considering the solvency of the borrower and the physical security for the granting of the loan than the viability of the investment project". 66/

62. Owners of small and medium-scale farms and particularly the former, are not able to seek credit on those terms since they generally cannot repay them in the established time-limit due to insufficient productivity, low prices and the lack of a guaranteed market for their products so that the debt becomes larger and larger.

63. The credit programme only covers financing of part of the annual operating costs of farm production units; it does not finance credit for investment, or for the acquisition of machinery, animals or building of the infrastructure; so states the credit programme on banking terms of the Integrated Rural Development Project in Ecuador, which then specifies that the credit granted per beneficiary will be the equivalent of 70 per cent of the cost of seed, fertilizer and pesticides, at an interest rate of 13 per cent per annum (equivalent to 1.8 per cent monthly). The repayment periods for each loan will be directly related to the growing cycle of the crop and will be granted to the extent that the requested inputs are required. 67/

64. Gómez, in his book, declares that the essence of socialist credit lies in the fact that it is a form of redistribution of monetary resources, which are

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64/ Op. cit. 57/, page 55.

65/ Op. cit. 26/, page 137.

66 Op. cit. 31/, page 4.

67/ Integrated rural development project. Tanicuchi. Toacaso. Pastocalle. Secretariat for Integrated Rural Development, Ecuador, project UNDP/FAO ECU-79-007. Volume 2, 1983, Annex 5, page 2.

temporarily free, in the hands of the bank, with the objective of using them in the most effective manner for developing the national economy and improving the material and cultural position of the workers. He cites the second objective of Resolution No. 21 1978 of the National Bank of Cuba which states that interest rates of 4 per cent and 6 per cent per annum shall be applied respectively to credits given to farming co-operatives and the individual farmer sector. In the case of extensions or overdue or unpaid loans, the aforementioned rates will increase to 5 per cent and 7 per cent for extended credits and 6 per cent and 8 per cent for overdue loans, for farming co-operatives and the individual farmer sector respectively. 68/

65. Agricultural training is a constant concern of FAO and other organizations. From analyses reflected in the final report of FAO on the national training centre in Peru in 1977 one of the recommendations which emerges is the need to consolidate the features of the system to provide a training which is permanent rather than informative, and more complete and integrated, deriving its subject matter from the problems facing each area. 69/ Many other training projects for agricultural workers have been reported, such as those developed by UNDP through FAO in the Lao People's Democratic Republic 70/ and El Salvador. 71/

66. Training in a particular country cannot be taken in isolation, but must be conceived within an integrated development plan covering the needs, at various levels, of each specialized area. There is therefore a need to create the structural conditions and resources to implement this, giving priority to the training of trainers.

67. The conclusions on the agricultural training activities in Africa, carried out by FAO, highlight more than 480 projects executed between 1979 and 1982, in which over 54,000 people were trained. 72/ One of the objectives of the project approved by UNDP for 24 countries in Latin America and the Caribbean, according to a report by the director, is that the principal approach is to support national research programmes, seeking to strengthen the capacity for testing, adapting and transferring new high-yield varieties and appropriate production technology to farmers. 73/

68/ Op. cit., pages 88 and 90.

69/ Assistance to the National Training and Research Centre for Agrarian Reform (CENCIRA), Peru. Results and recommendations of project AG:DP/PER/71/544, Terminal report, UNDP/FAO, Rome, 1977, page 62.

70/ Training of personnel in agricultural co-operatives, Lao People's Democratic Republic. Conclusions and recommendations of project ES:DP/LAO/78/001, Terminal report, UNDP/FAO, Rome, 1981.

71/ Training of farmers and farmworkers. El Salvador. Results and recommendations of project AG:DP/ELS/78/013, Terminal report, UNDP/FAO, Rome, 1984.

72/ FAO's Agricultural Training Activities in Africa. Prepared for the 13th FAO Regional Conference for Africa, Harare, Zimbabwe, Rome, 1984, page 1.

73/ International Co-operation for Technical Assistance and Vocational Training in Agricultural Production in Latin America (CIAT). (Fasell) RLA/83/004, Director's Report, 1984, pages 1 and 2.

68. This project takes account of the background when it states that the problems of agricultural production and nutrition have common features in various countries of the region. Among these features it includes malnutrition and points out in this respect that in Latin America some 50 million people are undernourished.

69. A very precise recommendation is found in the study on Tractor Supply and Demand in Mexico, to the effect that training centres in agricultural machinery should be set up in the various ecological regions of the country, with subsidies from the Federation and Governments of States aimed at training young farm workers in the use, maintenance and minor repairs of tractors and agricultural implements. 74/ The international FAO Panel of Experts on Agricultural Mechanization, strongly expressed the feeling of all member countries in concluding that there is a critical need for training, recommending four action programmes in this respect to be implemented by FAO and four to be carried out by the countries concerned. 75/

2.2.3 Agricultural mechanization

70. In considering agricultural mechanization in developing countries, the first consideration is the application of technologies which are appropriate to the conditions. In devising a strategy for the transfer of technology, its appropriateness and its net costs must be taken into account, it states in the Book on World Industries Since 1960: progress and prospects, 76/ which goes on to say that the strategies chosen will depend on the country's education, technology and science policies.

71. In its concluding report for project ES:DP/CHI/76/006, FAO indicates that in universities and experimental research stations there is a large quantity of data, research results and technical knowledge, but rarely are these adapted to the cultural characteristics, technological features and economic resources of the majority of family farmers 77/ and recommends that the technological measures proposed, in order to be adopted, should be consistent with the cultural background of the farmers, the physical characteristics of the farms and the economic habits of the farmers.

72. The application of appropriate technologies cannot be considered as holding developing countries back, but as a measure to match technology to their current situation followed by uninterrupted progress in the application of new technologies which will ensure the necessary development of these countries.

74/ Op. cit. 27/, page 99.

75/ 1. Agricultural Mechanization Strategy Formulation.
2. Tillage Practice in Low Rainfall Agricultural. FAO Panel of Experts on Agricultural Mechanization, Report of the Sixth Session, Turkey, 1984, pages 12 and 13.

76/ Op. cit. 26/, page 133.

77/ Entrepreneurial and organizational development of agricultural producers on family farms, Chile. Project results and recommendations, ES:DP/CHI/76/006, Terminal Report, UNDP/FAO, Rome, 1981, page 21.

73. The FAO Panel of Experts attaches great importance to the adaptation of agricultural machinery to small farms, calling on member Governments to encourage the testing and development of agricultural machinery for adaptation, whether at national or regional level, before recommending its widespread use. 78/ In the Special Programme for the Improvement of the Food Situation and Rehabilitation of Agriculture in Africa, the manufacture of simple low-cost agricultural implements adapted to the needs of the small farmer is proposed as a first specific measure for the support of agricultural activities by other sectors. 79/

74. Many organizations, Governments, centres and experts have been working and are working to develop technologies adapted to agriculture in developing countries, mostly using man or animals as the principal source of energy. Thus Hopfen and Biesalski 80/ in 1953 assembled a valuable collection of information on sources of motive power, implements and agricultural tools, making reference to bibliographies going back to 1916.

75. Bommer, in his inaugural speech at the Expert Consultation on the Appropriate Use of Animal Energy stated that in 1980 labour represented two-thirds of energy in the 90 developing countries which were analysed in the study, varying between 56 per cent in Latin America and 84 per cent in Africa. 81/ Draft animals provided on average a quarter of energy, although in Asia, which has two-thirds of the total number of draft animals in the world, it was 31 per cent. In this Consultation there were various recommendations made including the development and application of general policies for the use of draft animals and the provision of related equipment and thus the establishment of competent national authorities, by the States members 82/ and the value of beasts of burden to lighten the work of women and children was recognized ... 83/

76. Another recommendation made in the same Consultation is that the FAO should prepare a document on all aspects of the use of draft animals as a source of energy, including socio-economic considerations, and that it should be distributed to States members so that they could use it as a guideline in the formulation of national policies.

77. Anderson, in one part of his research, says that the trend towards tractors and mechanization with high capital investment appears to have weakened and a growing number of researchers and administrators now recognize the effect of this

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78/ Op. cit. 24/, page 6.

79/ Op. cit. 63/, page 9, paragraph 23.

80/ Hopfen, H. J. and Biesalski, E., Small farm implements, FAO Agriculture Series No. 5, Rome, 1953.

81/ Bommer, D. F. R., Inaugural Speech to the Expert Consultation on the Appropriate Use of Animal Energy in Agriculture in Africa and Asia, FAO, Rome, 1982, page 26.

82/ FAO, Report on the Expert Consultation on the Appropriate Use of Animal Energy in Agriculture in Africa and Asia, Rome, 1982, page 17.

83/ Ibid., page 20.

aspect. 84/ With regard to the reduced dependence on mechanization, the terminal report of project ES:DP/ETH/AC/015 even advocates the need to implement a systematic programme for replacing tractor power with draft animals wherever this is practicable and at the same time to introduce improvements in manual tools. 85/

78. Several research centres have concentrated on the development and promotion of equipment and machines primarily designed for animal traction, of which we mention just two examples: the Regional Centre for the Promotion of Agricultural Machinery in Mali 86/ where various co-ordinated projects are being implemented by the Ministry of Agriculture with the support of FAO and bilateral agreements with other countries; and the Central Gulf Agricultural Research Centre in Mexico, where a variety of equipment has been designed and built and will be gradually introduced into agriculture; a number of documents refer to this. 87/, 88/, 89/

79. Alongside the work being carried out by the above-mentioned organizations and institutions in connection with agricultural mechanization in general, most of them are also becoming involved in activities related to the management of water for irrigation and other needs in rural areas of developing countries, as part of the technology adapted to their conditions. Irrigation, in all its aspects is of the utmost importance for all countries and the study and development of irrigation is a matter of urgency for those areas which are lagging behind in this field, particularly those whose economy is based on agriculture and it is absolutely essential for regions affected by drought.

80. In the Special Programme of Action for the Improvement of Food and Rehabilitation of Agriculture in Africa it is emphasized that a large number of African countries are affected by drought and research shows that the desert is expanding into other regions at a rate of 8-10 kilometres per year. Of the 36 African countries which are facing serious food shortages, 24 of them are affected by desertification. 90/ The similarities of ecological conditions and farming methods make it appropriate that countries from different subregions should

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84/ Anderson, F. M., Draft Animals as a Source of Energy in Africa: A general view. Expert Consultation on the Appropriate Use of Animal Energy in Agriculture in Africa and Asia, FAO, Rome, 1982, page 37.

85/ Assistance to the Planning and Implementation of Large-scale Settlement for Rural Development, Ethiopia. Project finding and recommendations, ES:DP/ETH/AC/015, Terminal report, UNDP/FAO/Rome, 1983, page 41.

86/ Formulation of a Project for a Regional Centre for the Promotion of Agricultural Mechanization (CERPROMA) at Kayes, Mali. FAO technical co-operation programme, AG:TCP/MLI/0107, FAO, Rome, 1983.

87/ Op. cit. 52/, pages 20-22.

88/ Programme for agricultural mechanization and engineering in the wet tropics of Mexico. Cotaxtla Experimental Farm (CAECOT), Golfo Centro Agricultural Research Centre (CIAGOC), INIA, SARH, Information Bulletin No. 1, Veracruz, 1984, pages 7-13.

89/ Sims, B. G. and Moreno D., Weed control for the small farmer, 2. Mechanical control with animal-drawn cultivators, (CAECOT), CIAGOC, INIA, SARH, Technical Report No. 23, Mexico, 1984.

90/ Op. cit. 63/, page 11, paragraph 26.

jointly initiate programmes of research into crops and animal production and the training of teams of mechanics to manage the sector, as is set out in the Proposals for Food and Agriculture Development 1986-90 of the Economic Commission for Africa, 91/ which goes on to say that joint programmes must be devised for the exploitation of lakes, rivers and natural forest resources which must be shared between a number of countries.

81. Various types of manual pump have been used for the irrigation of small plots, and to satisfy other water needs in rural areas, water being essential for human life, animal life and crop cultivation, as Hopfen writes in his work on Farm Implements for Arid and Tropical Regions. 92/ In addition, in the conclusions of the terminal report of the project for the Regional Centre for the Promotion of Agricultural Machinery in Mali, it is stated that there is very little experience relating to pumping equipment. It is consequently necessary to look into types of pumps for the irrigation of small plots and high-discharge pumps used in riverside locations. 93/

82. Water pumping equipment in industrialized countries has reached a high level of development, but its use is very limited in rural zones of developing countries since it requires electrical power or the use of internal combustion engines and it is for that reason that simpler methods and other sources of energy are being sought.

83. At the present time various types of manual pumps are being introduced to agriculture in developing countries, using different types of energy, as is the case with the project financed by Libya in Mali, one of whose objectives is to introduce manual pumps for irrigating plots of 3-4 hectares and large-capacity pumps. 94/ We can also see that simple methods for boring wells are being studied, such as those designed in the Department of Agriculture Mechanization and Engineering in Veracruz, Mexico or drilling wells to depths of 12 metres with a diameter of 100 mm, together with research into various types of pumps including those using wind energy. 95/ There is also the India-Mali pump; according to its manufacturers, Mali is the first West African country to manufacture its own pumps in their entirety and export them. 96/

91/ Proposals for Food and Agriculture Development 1986-90. United Nations, Economic and Social Council. Economic Commission for Africa. Sixth Meeting of the Technical Preparatory Committee of the Whole, E/ECA/CM.11.39, Addis Ababa, Ethiopia, 1985, page 17, paragraph 59.

92/ Hopfen H. J., Farm Implements for Arid and Tropical Regions. FAO: Agricultural Development Paper No. 91, Rome, 1970, page 142.

93/ Op. cit. 86/, page 4.

94/ FAO/Government Programme of Co-operation, Operating Plans. Regional Centre for the Promotion of Agricultural Mechanization, GCP/MLI/014/LIB, Mali, page 3.

95/ Op. cit. 88/, pages 17-21.

96/ India-Mali, Manual Water Pumps for Deep Wells and Bores. Malian Enterprise for Mechanical Maintenance and Construction, Emama, Sikasso, Mali, page 1.

84. All the studies refer to the importance of training in this sphere, as observed in the project for reinforcing the Irrigation Unit in Panama which recommends in its terminal report that the training of national technicians should be continued, particularly at engineer level, through studies, design, works and irrigation assistance. 97/ Another point of interest here is the recommendation that national irrigation and drainage plans should be developed alongside agro-industrial plans.

85. Apart from those already described, many other projects are being implemented with a view to improving the status of agriculture and life in rural areas: project for Support to Small Farmers in Liberia, 98/ one of whose objectives was to introduce improved technology in selected areas for various crops, the small farm mechanization programme in Kenya 99/ and the project for Post-Harvest Crop Losses in Mali 100/ which includes improvement of storage, introduction of milling and other equipment for post-harvest processing and staff training.

86. The formulation of a Strategy for Agricultural Mechanization, recommended by the FAO Expert Panel in its sixth session, 101/ covers the action which must be undertaken by this organization and its member countries, from date of collection of information, required resources, organizational structure, co-operation and selection of personnel to implement this strategy. The long-term strategies for increasing food and agricultural production discussed in the technical preparatory committee of the Economic Commission for Africa, 102/ offers suggestions concerning agricultural training, research and development of possibilities for agricultural technology and its transfer, development of physical, structural and social infrastructure, environmental effects, interregional and inter-African co-operation and investment of resources.

2.2.4 Industry-agriculture links

87. Commenting on the difficulties encountered in rural industrialization, UNIDO in its Industrial Development Study, prepared for its Third General Conference, expresses the view that "a too narrow interpretation has often led to the promotion only of village crafts and industries or services to achieve village-by-village self-sufficiency. This in itself will not achieve the objectives of

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97/ Institutional Technical Support for the Irrigation Unit (Phase II), Panama, Results and Recommendations of the Project, AG:DP/PAN/80/001, Terminal Report, FAO, Rome, 1982, page 14.

98/ Support to Small Farmers and Extension Services, Liberia. Project Finding and Recommendations, AG:DP/LIR/76/002, Terminal Report, UNDP/FAO, Rome, 1980, page 4.

99/ Small Farm Mechanization Programme. Ministry of Agriculture and Livestock Development, Land Development Division, Nairobi, 1984, pages 1-4.

100/ Prevention of Post-Harvest Crop Losses. IC/UNDP Follow-Up Working Paper, MLI/83/003, Mali, 1984, pages 1-6.

101/ Op. cit. 75/, pages 10-13.

102/ Op. cit. 91/, pages 10-19, paragraphs 30-66.

employment promotion and income redistribution. Options should be kept open for a variety of sizes and technological levels of industrial enterprises to be located in rural areas." 103/

88. In its work on Conditions of Entry into the Capital Goods Sector, UNIDO states that "the development of rural industries could carry important implications for agricultural mechanization. The prospects of increasing the level of knowledge and mechanical skills of rural population can also be opened through the development of rural industries. However, in many cases, the socio-political feasibility and the economic and technological feasibility of rural industrialization programmes do not simultaneously exist. Examples from developing countries suggest that, in such cases, the government objectives and decisions would be the determining factors." 104/

89. The same document also makes reference to the manner in which production can be carried out in rural workshops, specifying that "ideally, rural workshops could operate within a network consisting of a number of decentralized workshops and a central production unit. Depending upon their development level, the rural workshops can form the finishing and assembly of manufacturing kits of semi-finished machines distributed by the central unit; and/or they can be sub-contracted by the central unit to manufacture finished and semi-finished parts; and/or they can carry out the complete manufacture of some machines. Repair and maintenance of all this machinery could also be carried out by the rural workshops." 105/

90. With regard to the foregoing, it is important for industrialization plans in developing countries to include at least the manufacture or reconditioning of replacement parts required by simple agricultural machinery in workshops which can be set up locally alongside agro-industries in rural zones.

91. Diversification, according to Gürkök, can lead to greater utilization of available resources in developing countries. However, its implementation would not be a simple task, bearing in mind the specialized structure of production in developed countries, and it can be said that there is little opportunity to encounter technologies where experience is diversified. Consequently this experience must be developed in the countries which are in course of development. 106/ On the other hand, "diversification of agricultural machinery is essential for countries that wish to control the agricultural and rural process at all its stages (handling, transport, pre-treatment, distribution, irrigation), especially in the case of agricultural intensification." 107/

92. A large number of developing countries are carrying out integrated rural programmes either internally or with the co-operation of international or regional organizations. We refer again to the profound and sustained effort which the Government of Cuba is carrying out in integrated rural development, the main

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103/ Op. cit. 26/, page 281.

104/ Op. cit. 18/, page 91, paragraph 158.

105/ Ibid., page 84, paragraph 166.

106/ Op. cit. 38/, page 48, paragraph 99.

107/ Op. cit. 21/, page 10, paragraph 19.

achievements of which are set out in the Report of the Progress of Activities in the Agrarian Reform and Rural Development Sector, 108/ and also project ECU/79/007 which UNDP is implementing through FAO in Ecuador and which comprises 13 programmes for the setting up of farm production units. 109/

93. Project CGID/UNIDO/MEX/82/016 on the Promotion and Development of Integrated Agro-industries in Mexico, 110/ which was recently concluded, covers aspects of great interest on this topic. The Working Documents for Agro-industrial Development of the Secretariat for Agriculture and Water Resources, for example No. 2 in 1982 on Agro-industrial Development and the Rural Economy contains interesting matters in this connection. 111/ Reference might also be made to the terminal report of the project on agro-industrial development by the Government of Mexico with UNIDO 112/ which points out, in one of its sections, that farmers have historically been the group most marginal to the process of economic growth and have not shared in the benefits arising from economic and social development. So the integration of agro-industry with primary producers of the social sector (farmers) has the advantage of rendering the plan to achieve greater social justice in development both valid and viable.

94. Previously, in the same document, three types of enterprise are defined, according to the form of ownership: agro-industrial enterprises which are the property of primary producers at that social level organized in the form of co-operatives, common land collectives, common land unions etc.; State-farmer co-ownership enterprises, of a transitional nature, designed to make the above forms viable and consolidate them; State enterprises established in those areas not covered by the previous forms of ownership and organization, particularly in those areas defined as being of strategic importance, which give primary producers a share in the benefits derived from their raw materials or labour. 113/

95. The Board of the Cartagena Agreement, promoting the implementation of farming projects, comes out in favour of providing urgent incentives to agriculture and agro-industry, factors which are given special emphasis in Andean integration because they lead to a self-sufficiency which is the target of the Andean process, together with raising the standard of living among the rural population, which in general is the most impoverished in the subregion. 114/ Efforts are also in progress through the Andean Project for Technological Development in Rural Areas

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108/ Op. cit. 55/.

109/ Op. cit. 67/.

110/ Op. cit. 31/.

111/ Agro-industrial Development and the Rural Economy. Secretariat for Agriculture and Water Resources, working documents for Agro-industrial Development No. 2, Mexico, 1982.

112/ Op. cit. 32/, page 82.

113/ Ibid., pages 15-16.

114/ Action in support of Bolivia. Andean Group, Board of the Cartagena Agreement Newsletter No. 129, 1982, page 7.

(PADT - Rural). 115/ Mention should also be made in this context of the plan being developed by the Economic Commission for Africa with the co-operation of the United Nations, an evaluation of which was recently completed 116/ and for which proposals for 1986 to 1990 have been formulated. 117/ Chung, in his Study of the Agricultural Extension Experiences, also pays special attention to the rural integration development programme. 118/

96. Rural integration should not be thought of as an isolated solution in the agricultural sector but rather as part of a plan of national integration fitted to the characteristics of the individual country and which is effective when suitable definitions and political guidelines on the subject are provided by the State.

2.2.5 State participation and co-operation

97. The importance of State participation in the development of the agricultural machinery industry and the mechanization of agriculture is fully reflected in documents 1 and 2 prepared for the Second Consultation on the Agricultural Machinery Industry, where it is stated that "the role of the State in the development of the agricultural machinery industry has been decisive in the countries with planned economies, while the market mechanisms, investments and RD of the private sector have dominated the process in the other producing countries. In all cases, the public authorities play a decisive indirect role (import policy/protection of local industry, foreign investment regulations, orders from the State and publicly owned enterprises, organization and policy of the agricultural and rural sector, export credits and aid to industry)." 119/

98. It is also made clear that "to develop multi-product production units, Governments would have to introduce institutional mechanisms and plans into both agricultural and industrial sectors, which would mean policy action and legislation." 120/ It had already been pointed out in the course of the First Consultation on the Capital Goods Industry that the Governments of some developed countries had taken measures in regard to investment insurance, export credits, etc." 121/

115/ PADT - Rural initiates action. Andean Group, Board of the Cartagena Agreement Newsletter No. 125, 1983, page 7.

116/ Evaluation of the Implementation of the Regional Food Plan for Africa (1978-1984) and a Preliminary Assessment of the Food and Agricultural Aspects of the Lagos Plan of Action. United Nations, Economic and Social Council. Economic Commission for Africa, Sixth Meeting of the Technical Preparatory Committee of the Whole, Addis Ababa, Ethiopia, E/ECA,CM,11/17, 1985.

117/ Op. cit. 91/.

118/ Chung, Y-B., and Dong, Y-M., A Study of the Agricultural Extension Experiences, Republic of Korea, Korea Rural Nutrition Institute, FAO, Rome, 1984, page 61.

119/ Op. cit. 21/, page 13, paragraph 31.

120/ Op. cit. 23/, page 2, paragraph 4.

121/ Op. cit. 16/, page 17, paragraph 67.

99. There are generally also protectionist measures by industrialized countries to establish strong barriers against the development of non-industrialized countries, strangling their exports and limiting investment which might generate such development. There is a need to combat and eliminate such a policy which is so damaging to poor countries.

100. In practically all the specific projects reference is made to State intervention; for example we have the request that the Government should take action with longer-term programmes, including land development, in connection with a UNDP/FAO project for implementing the mechanization of small farms in Nigeria. 122/ With regard to State support for farmers' co-operatives and associations in Cuba, the explanation is given that this support is channelled through a broad network of establishments which provide inputs and services for production. An example of this is that in the last five years more than 4,500 tractors of different types, 4,800 items of irrigation equipment, some 1,000 self-propelled machines and about 10,000 agricultural instruments have been sold to co-operatives; in addition productive inputs such as fertilizers, pesticides, fuel and other items are supplied in quantities appropriate to the production programme. 123/

101. Any strategy in this area must take into account international, regional and subregional co-operation, co-operation between countries and even between institutions at national level. The Second Consultation on the Agricultural Machinery Industry stresses in its conclusions "the need to take concrete action in order to improve the conditions of international industrial co-operation (both North-South and South-South) and of commercial and industrial relations between interested partners; it could take the form of the elaboration by UNIDO of a framework to facilitate the establishment of contacts and to improve the effectiveness of such co-operation in the field of agricultural machinery and related rural equipments." 124/

102. "Co-operation between developing countries, particularly those already producing agricultural machinery, should aim at strengthening capabilities in the areas of: equipment, design, research and development, and information; and at establishing policies for the agricultural machinery and capital goods sectors within the framework of a programme agreed upon by the countries concerned, notably at the subregional level." This is the view expressed in document No. II, 125/ prepared by the UNIDO Secretariat for the above-mentioned Consultation, which goes on to say that "co-operation between developing and developed countries including Governments, institutions (financial, engineering, research and development and design) and manufacturers, which until now has been based on the purchase and sale of equipment, should take into account the desirability of multi-product production techniques, development of manufacturing technology and product design in the area of agricultural machinery within the framework of the capital goods sectors."

122/ Agricultural Mechanization (Kaduna), Nigeria. Project Finding and Recommendations, AG:DP/NIR/75/021, Terminal Report, UNDP/FAO, Rome, 1980, pages 14-15.

123/ Op. cit. 55/, page X.

124/ Op. cit. 5/, page 5, paragraph 8.

125/ Op. cit. 23/, page 2, paragraphs 5 and 6.

103. International co-operation as analysed in the publication Industry 2000 - New Perspectives reveals a great variety of relationships. 126/ Long-term intergovernmental agreements on scientific and industrial co-operation play an important role in East-West relationships and are primarily conceived to create the preconditions for practical work leading to concrete co-operation. The methods used in East-South relationships deserve attention in that they seek to achieve adequate consolidation of a set of regulations for bilateral international industrial co-operation. With regard to West-South co-operation, it points out that intergovernmental agreements between the market economies and developing countries relating to industrial investment lay emphasis on the protection of foreign investments.

104. In a section on South-South co-operation agreements, the same document states that here the development of co-operation models relating to specific regional or bilateral co-operation projects can be useful, drawing on the experience gained from the co-operation in Latin America, the Council for Mutual Economic Assistance and the European Economic Community. In one of his conclusions, Gürkök emphasizes the possibility of increasing the inclusion of medium- and small-scale enterprises in developed countries in co-operation projects with counterparts in developing countries. 127/

105. In the analysis of long-term strategies for increasing food and agricultural production in Africa it is pointed out, with regard to inter-African and interregional co-operation, that the emphasis placed on the development of research and transfer of technology makes it necessary to increase international co-operation in this area to the greatest extent possible. Despite this, it is important to give a higher priority to inter-African co-operation. 128/ Furthermore, in the Second Regional Workshop on Farm Machinery Testing Procedures it is proposed that the Economic Commission for Africa (ECA) should focus on the possibility of supporting institutional arrangements for co-ordinating the testing and development of agricultural equipment, exchange of information, experience and training opportunities in the region; seek financing for the development of equipment projects; and establish links with similar organizations in other parts of the world. 129/

106. International co-operation projects, some of which have already been mentioned, have been carried out, are being carried out and are at the planning stage on a considerable scale throughout the world. We also have the 10 reported in the terminal report on the National Training and Research Centre for Agrarian Reform in Peru; 130/ the 11 described in the preparatory document for the follow-up to the World Conference on Agrarian Reform and Rural Development in Ecuador; 131/ the 120 identified in Mitra's report on the mission to five African

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126/ Industry 2000 - New Perspectives. United Nations Industrial Development Organization, United Nations, New York, 1979, pages 164-166.

127/ Op. cit. 38/, page 48, paragraph 98.

128/ Op. cit. 91/, page 16, paragraph 57.

129/ Op. cit. 44/, pages 9 and 10.

130/ Op. cit. 69/, pages 29-30.

131/ Op. cit. 34/, pages 176-178.

countries, of which the vast majority require assistance, with 38 needing UNIDO co-operation and in a few cases that of UNESCO and ILO; 132/ and the nine reported in the Summary of the Activities of the Agricultural Mechanization Division of the Ministry of Agriculture in Mali. 133/

107. The terminal report of the Centre for Agricultural Mechanization in Iraq, on the subject of relations with other institutions, states that the Centre should maintain a very close association with agricultural production in the country and with training and research institutes in order to obtain up-to-date information on the requirements for agricultural mechanization. Without such information, it is not possible to recommend at national level the provision of appropriate machinery. At international level it is recognized that the advance of science and technology is increasing through the exchange of information. Links must therefore be established between the Centre and institutions in other countries working in the same field. 134/

108. These are the reasons why we attach great importance to regional centres, taking the view that they must assume an increasingly active role in the co-ordination of co-operation actions between States and between States and regional and international organizations in order to obtain optimum orientation and achieve maximum effectiveness.

109. Special mention is due in this context to a newly-formed institution, the African Regional Centre for Engineering Design and Manufacturing (ARCEDEM) in Ibadan, Nigeria, 135/ sponsored by the Economic Commission for Africa (ECA) in collaboration with the Organization of African Unity (OAU) and the United Nations Industrial Development Organization (UNIDO), which has 23 member countries and has set out major objectives and work programmes for the industrial development of the region, such as the selection of four countries for the promotion of national centres in 1984-85 and a further four in 1985-86. 136/

110. In his report on the mission to five African countries, Mitra recommends the installation at national level of an inter-ministerial co-ordinating committee for the development of the metal and engineering industries and the formation, at

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132/ Mitra, A. K., Report of the Field Mission in Kenya, Uganda, Tanzania, Zambia and Mauritius for Upgrading Existing Foundry, Forging, Heat Treatment, Machine Shop, Tool Room and Identification of the Manufacture of Selected, Agricultural Machinery, Capital Goods and Spare-Parts. ECA/UNIDO, Addis Ababa, 1980, pages 7-26.

133/ Summary Report of the Activities of the Agricultural Mechanization Division 1983-1985, National Consultative Committee for Agricultural Mechanization, 8th session, Bamako, Mali, 1985, pages 2-4.

134/ Centre for Agricultural Mechanization, Sweira, Iraq. Project Finding and Recommendations, AG:DP/76/005, Terminal Report, UNDP/FAO, Rome, 1982, page 12.

135/ African Regional Centre for Engineering Design and Manufacturing. Economic Commission of Africa, Ibadan, Nigeria, 1983.

136/ Work Programme 1985-86. African Regional Centre for Engineering Design and Manufacturing, Ibadan, Nigeria, 1984, page 3.

inter-State level, of a subregional multinational consultancy company for the development of agricultural machinery and metal alloy products. 137/

111. A good example of how international help can pave the way for a substantial increase in food production in the short term, in a specific region of a developing country, is shown in the example of the International Fund for Agricultural Development (IFAD) and the Republic of Cuba, according to Orlando Gómez. 138/ Very recently there was discussion in the Meeting of Donors for the Rehabilitation of Agriculture in Africa, sponsored by FAO, of agricultural rehabilitation projects proposed for 20 countries in the region affected by food shortages due in the first place to drought, as a result of which more than 150 million people were suffering from hunger and malnutrition. 139/

112. In order to give a more precise idea of the enormous need to achieve fruitful international co-operation leading to a reduction in the vast gulf between developing and developed countries we need refer to only two aspects extracted from the following publication. In the UNIDO Guides to Information Sources No. 8 140/ are listed 489 national organizations dealing with agricultural machinery in 124 countries. Of those 222 belong to 27 developed countries with an average of 8.22 organizations per country and the remaining 267 belong to 97 developing countries with an average of 2.75 organizations per country, or, to put it another way, the developed countries have at the present time almost three times as many organizations as developing countries even without taking into account the differences in technical and scientific levels between these organizations.

113. The other element, of an economic nature, is taken from the Global Report 1985 on industry and development, 141/ also by UNIDO, where in 1981 it is noted that, of the countries mentioned, there were as many countries with per capita incomes above $10 per day as those with per capita incomes less than $1 per day. There were developed countries with per capitas of around $40 per day while there were developing countries with per capitas around 20 cents per day or a ratio of 200:1, which is to say that 200 people in poor countries were living on the same amount, on average, as one person from the rich countries.

114. In concluding this bibliographic section, we are even more convinced that the advances in industrial development of agricultural machinery and agricultural mechanization have done little to change the critical state of third world countries in this area and that today more than ever we should all work together to bring about the transformation which these countries desperately need.

137/ Op. cit. 132/, pages 5-6.

138/ Op. cit. 46/, page 114.

139/ Rehabilitation of Agriculture in Africa. Meeting of Donors, General Debate, FAO, Rome, 1985, page 2.

140/ Information Sources on the Agricultural Implements and Machinery Industry. UNIDO Guides to Information Sources No. 8, United Nations, New York, 1982, pages 4-53.

141/ Industry and Development. Global Report 1985, UNIDO, Vienna, United Nations, New York, 1985, pages 138-296.

CHAPTER 3

LIST OF ORGANIZATIONS, INSTITUTIONS AND CENTRES VISITED, BY COUNTRIES AND BY ASPECTS ANALYSED IN EACH

3.1 List of organizations, institutions and centres visited, by countries

3.1.1 Europe

115. Austria:

- United Nations Industrial Development Organization (UNIDO), Vienna.

116. Italy:

- United Nations Food and Agriculture Organization (FAO), Rome.

3.1.2 Africa

117. Ethiopia:

- Economic Commission for Africa (ECA) and the Commission's Joint Divisions responsible for relations with UNIDO and FAO, Addis Ababa.

118. Nigeria:

- African Regional Centre for Engineering Design and Manufacturing (ARCEDEM), Ibadan.

119. Mali:

- United Nations Development Programme (UNDP), Bamako.
- United Nations Food and Agriculture Organization (FAO), Bamako.
- National Directorate for Rural Engineering of the Ministry of Agriculture. Agricultural Mechanization Division (DMA), Bamako.
- Centre for Experimentation and Research on the Mechanization of Agriculture, Committee on Engineering Education in Middle Africa (CEEMA), Samanko.
- Malian Society for Agricultural Equipment, Construction and Research (SMECMA), Bamako.

3.1.3 Latin America

120. Mexico:

- United Nations Industrial Development Organization (UNIDO), Mexico City.
- Secretariat for Agriculture and Water Resources (SARH), Mexico City.
  - National Programme for Rural Development.
  - General Co-ordination of Agro-industrial Development.

- National Institute for Agricultural Research (INIA). Gulf Agricultural Research Centre (Centro CIAGOC). "Cotaxtla" Experimental Farm, Veracruz.

- Secretariat for Trade and the Promotion of Industry (SECOFI), Mexico City.

- Programming and Budget Secretariat (SPP), Mexico City.

- Servicios Ejidales Sociedad Anónima (SESA), Mexico City.

- Expresa Avios y Accesorios Metálicos, Veracruz.

- Ejido "Mozambique", Medellin de Bravo, Veracruz.

- Ejido "General Juan Elvera", Atlixco, Puebla.

121. Ecuador:

- United Nations Industrial Development Organization (UNIDO), Quito.

- United Nations Food and Agriculture Organization (FAO), Quito.

- Ministry of Industry, Commerce and Integration (MICEI), Quito.

- Ministry of Agriculture and Livestock (MAG), Quito.

- Secretariat for Integrated Rural Development (SEDRI), Quito.

- National Council for Science and Technology (CONACYT), Quito.

- National Development Bank (BNF), Quito.

- Ecuadorian Capital Goods Commission (CEBCA), Quito.

- National Office for Technical Advisory Services to Industry (DINATI), Quito.

- Industrial Development Centre of Ecuador (CENDES), Quito.

- National Centre for the Promotion of Small-Scale Industry and Crafts (CENAPIA), Quito.

- Pichincha Chamber of Industry, Quito.

- Pichincha Chamber of Small-Scale Industry, Quito.

- National Federation of Chambers of Small-Scale Industry (FENAPIA), Quito.

122. Cuba:

- United Nations Development Programme (UNDP), Havana.

- Ministry of Agriculture (MINAGRI), Havana.

  - Mechanization and Supply.

  - Agricultural Machinery Research Institute (IIMA).

- Agricultural Machinery Testing Station.
- Union of Machine Manufacturing Enterprises.
- Irrigation and Drainage Research Institute (IIRD).

- Ministry of the Sugar Industry (MINAZ), Havana.
- Ministry of the Steel Engineering Industry (SIME), Havana.
- National Association of Small Farmers (ANAP), Havana.
- Ministry of Higher Education (MES), Havana.
- Havana Advanced Institute for Agricultural Science (ISCAH), Havana.
  - Agricultural Mechanization Centre (CEMA).
  - Faculty of Agricultural Mechanization.
  - Faculty of Irrigation and Drainage.
  - Faculty of Agronomy.
  - Faculty of Livestock Breeding.
  - National Institute of Agricultural Science (INCA).
  - Institute of Animal Science (ICA).
  - "José A. Echevarria" Advanced Polytechnical Institute (ISPJAE), Havana.
  - Faculty of Machine Manufacture.

3.2 Aspects analysed in each country

123. Austria:

- Preparation of the general research programme.
- Selection of countries to be visited.
- Preparation of the list of aspects to be analysed in each country.
- Review of information on work carried out on the subject of the agricultural machinery industry.
- Results of Consultations and Expert Group Meetings on the subject.
- Development of criteria to be taken into account in the Second Meeting of the International Expert Group Meeting on Agricultural Macninery, to be held shortly.

124. Italy:

- Results of the analysis of the situation of agriculture in various regions of the world.

- The principal areas of agricultural production that it is planned to stimulate to relieve the food supply situation in developing countries.

- Structure of different forms of land tenure, and associative forms of production. Appropriate mechanization models.

- Consultations on the progress of agrarian reform. Its results.

- Level of introduction of technology, in particular mechanization of small- and medium-scale enterprises.

- Agricultural training systems and services.

- Evaluation of possible co-operation between agrarian policy and policy for the manufacture of and technical assistance for agricultural machinery.

- International co-operation projects with developing countries.

125. Ethiopia:

- Influence of the economic situation of countries in the region on the introduction of agricultural machinery. Ideas for overcoming the problem.

- Relationship between the application of mechanization and displacement of agricultural labour. Ways of avoiding it.

- Food situation in the region as a function of supply of agricultural products.

- State of the market for the sale of agricultural products.

- Installed capacity for the production of agricultural machinery, including irrigation, degree of utilization and economic situation.

- Facilities provided by the Commission to increase the use of mechanization in agriculture.

- Participation by States in the financing of agricultural machinery.

- Co-operation contracts between countries for construction, technical assistance and training in the agricultural machinery sector.

126. Nigeria:

- Lines of machines being designed to meet the needs of small- and medium-scale enterprises. Prices and payment facilities.

- Local industries in countries of the region which manufacture machines or their component assemblies. Whether multi-purpose or not. Their profitability, utilization of installed capacity and possibility of adaptation.

- Volume of demand for machinery by small- and medium-scale enterprises. Degree or level of acquisition.

- Participation of farmers in the design of machines and participation of industry in the training of farmers.

- Participation of States in the financing of machinery, both in its manufacture and introduction.

- Manufacture and supply of replacement parts, technical maintenance and service in general.

- Installations for research and machine testing in the region.

- Co-operation between developing countries and between developing and industrialized countries.

127. Mali:

- Structure of land tenure in accordance with the scale of enterprises. Associative forms of production.

- Types of cash and subsistence crops, level of application of machinery. Development of livestock farming.

- Characteristics of geographical areas: soils, topography, vegetation etc.

- Mechanized irrigation and possible development. Construction of irrigation equipment.

- Supply of national agricultural products and their marketing.

- Relationship between mechanization and displacement of labour. Options for solving the problem.

- Participation of national industry in the production of tools and machines for agriculture. Research and testing.

- State participation in the financing of agricultural machinery, training and services.

128. Mexico, Ecuador and Cuba:

- Scale of agricultural enterprises. Their proportion.

- Co-operation between agricultural produce enterprises. Associative or co-operative forms.

- Composition of cash and subsistence crops and livestock breeding.

- Characteristics of geographical areas: soils, topograpny, etc.

- Agricultural machinery industries, their characteristics. Degree of utilization of their installed capacity. Possible adaptations to produce specific types of machines.

- Possibility of transforming local raw materials and workshops to produce or repair agricultural machinery.

- Existence or possibility of installing, where they do not exist, facilities for carrying out researcn and testing macninery. Possible regional co-operation.

- State of supply and marketing of local food products.

- Agro-food industries linked to agriculture.

- The labour situation in agricultural enterprises, particularly small- and medium-scale.

- Participation of States in the development of agriculture and industry, particularly with regard to mechanization.

- Co-operation between developing countries and with industrialized countries.

CHAPTER 4

ASSESSMENT OF THE MOST IMPORTANT ASPECTS ANALYSED DURING THE VISITS

129. In general terms replies were obtained on all aspects, the thoroughness of the responses depending on the information available to the officials and specialists contacted, much of which could be verified in practice. We consider that all the information collected in the course of interviews and observations is of great value for distillation of the accumulated experience which it embodies and for setting out considerations, conclusions and recommendations which may clear the way for immediate development and establish conditions for the future.

4.1 Situations common to the majority of developing countries

130. From the information received and the bibliography reviewed we can extract a series of features or characteristics which are generally applicable to the vast majority of developing countries and which are manifested to varying degrees in the life of their respective peoples. These include:

(a) Millions of human beings are suffering from hunger and dying directly or indirectly because of malnutrition resulting from food shortages in their countries due to the disastrous conditions faced by their agriculture, the economic crisis and market conditions which prevent them acquiring food in developed countries. Disastrous indicators in Africa are further accentuated by natural adversities.

(b) The agricultural machinery industry and the mechanization of agriculture is technologically very backward, and this is particularly notable in the African region.

(c) Installed capacity in small- and medium-scale enterprises for producing agricultural implements and machinery to meet the needs of that type of agriculture is inadequate. Even so, existing capacity is under-utilized for a number of reasons.

(d) There is a continuing tendency to increase the introduction of imported machines or those manufactured in national or transnational enterprises, which are not suited for this type of agriculture, basically due to structural and economic conditions.

(e) Integrated manufacture using multi-purpose plants, in small- and medium-scale enterprises, has not shown the hoped-for rise and with it increased utilization of their installations to achieve expanded production of capital goods, including agricultural machines, parts and components.

(f) Agro-industry continues to be basically controlled by large enterprises, predominantly transnational in several countries, and there has been a failure to integrate it into the rural environment so as to increase employment among farmers and their participation in the benefits.

(g) The current conditions for transforming raw materials and efficient and rational utilization of energy sources are not favourable in many countries but there are ample possibilities of achieving this in the near future.

(h) Water resources, which are generally scarce, are not adequately protected, preserved and exploited so as to improve agricultural production and prevent soil erosion, desertification and in some cases flooding.

(i) There is little incentive to achieve new targets since small- and medium-scale enterprises have to cope with various factors which restrict them, and loans, particularly for agriculture, are becoming more and more difficult to obtain. To this must be added the negative influence exerted in several respects by the large enterprises, whether national or transnational, on the development of the small and medium ones in the majority of countries.

(j) There has not been an appropriate development of new forms of association or co-operatives to promote the utilization of the more advanced industrial and agricultural technologies. Save in exceptional cases, the necessary attention and guidance has not been given to those already in existence.

(k) Rural development plans are isolated and in many cases do not have a truly integrated approach and generally do not have sufficient force to ensure that the products obtained are of the right quality, and are maintained and constantly developed for the benefit of the rural population.

(l) The number of institutions for education and research in these fields is scant if we bear in mind the need for training and data applicable to development in these countries. Moreover, the output of such institutions is in most cases not properly used.

(m) Regional co-operation in this subject area is slight but there is considerable opportunity for expansion, bearing in mind the features which are common to different countries and the interests each has in participating harmoniously in such co-operations.

(n) The mechanisms, routes and strategies so far established have not contributed, in any significant manner, to overcoming the serious difficulties faced by the developing countries in the field which is the subject of this study. There is evidence of generalized stagnation and even retrogression in some aspects.

(o) There is an imperative and urgent need to undertake joint integrated action to enable firm, progressive and enduring steps to be taken to respond immediately to the most pressing problems and put forward, in the medium and long term, solutions to other more complex ones. The current international situation is psychologically and politically favourable for this.

131. The underdeveloped agriculture of these countries is based on small- and medium-sized plots, which are continually further divided for reasons of inheritance and other factors, so that the cultivable area and the possibilities for using more advanced techniques are reduced. Hence the need to work along the lines of seeking new forms of organization and land use.

132. Farmwork generally consists of manual labour or the use of draft animals and rudimentary implements. In the best of cases, where there is a kind of family economy to make it possible, other types of machines are hired to carry out specific tasks. The latter is a function of enterprises which buy the machines and provide the service at prices which normally are not in line with the results of production, making the latter dearer, particularly when yields are low.

133. Nevertheless, we can be certain that it is the wish of farmers to own their own machines, unrealizable dreams in their current economic situation and given the scarce facilities available to them to achieve this. Consequently, small farmers rarely use these means and continue traditional practices with the corresponding human effort and meagre output which often is insufficient for the subsistence of the family.

134. The foregoing also results, in consequence, in inadequate supplies to the remainder of the non-farming population which receives a high proportion of the food products it consumes from this source, since the large enterprises gear their production primarily to exports. Even more serious is the fact that many foods are only grown on small farms and if supplies are insufficient, countries are obliged to import them with consequent indebtedness, and there are even cases where not long ago countries which were exporters of certain food products are now importing them in considerable quantities.

135. The manufacture of simple, hard-wearing and economic machines, as a starting point for agricultural mechanization, has not been sufficiently developed and is practically at a standstill in these countries, although it can almost be said that in the majority of cases it has not been started. In many countries there are possibilities in terms of raw materials and industrial capacity to make a beginning and then, progressively, to improve both capacity and technological complexity, to meet requirements and speed up the march of science and contemporary technology, while laying the foundations in countries which do not possess them.

136. Despite these possibilities, there are factors which restrict this development, among them the lack of credits or only those with high interest rates and tariff systems which sometimes favour the import of machinery from developed countries and impose restrictions on the acquisition of raw materials for domestic industry, particularly small- and medium-scale enterprises, capable of producing this type of machine adapted to the features of the respective countries.

4.2 Advantages of a domestic agricultural machinery industry and agricultural mechanization for developing countries

137. It is important to make every effort to overcome the above-mentioned obstacles and create the technical basis for the design, construction and testing of prototypes, as well as experimentation with agricultural machines in order, with regional and international co-operation, to permit domestic manufacture and introduction of machines into agriculture, with the following advantages to developing countries:

(a) Transformation and utilization of local raw materials, obviating the need to sell them cheaply to industrialized countries and then repurchase them in the form of finished goods at elevated prices.

(b) Increased employment to bring existing industrial capacity into operation, and also the opening up of new capacity, including the training, promotion and purchase-sales structure which this requires.

(c) Involvement of various institutions, such as agricultural and polytechnical universities and agricultural and industrial research and testing centres, thus increasing the scientific, technical and cultural potential.

(d) Alleviation of the subhuman working conditions of small farmers and making their land more productive, improving their standard of living and gradually bringing them up to the stage of development they have in industrialized countries.

(e) Reduction in the migration of the rural population to the cities which is more and more rapidly increasing unemployment and poverty and causing a deterioration of services in urban nuclei.

(f) Furthering conditions to stimulate forms of associative or co-operative arrangements between industrialists and farmers, to make enterprises more viable, productive and more efficient.

(g) Improvement in the supply of domestic farm products to the whole population thus raising the nutritional level which is extremely low at the present time in the vast majority of developing countries.

(h) Contribution to economic recovery, which is the subject of energetic discussion in poor countries at the present time, by effectively protecting national resources, reducing imports and possibly increasing exports.

(i) Resistance to the unequal exchange to which, in the current economic order, developing countries are subject, leading them into debt and making them dependent on developed countries, under the rules established by the market economies.

(j) Stimulation of regional co-operation and integration by expanding mutually advantageous exchange of technical assistance, including technology, research, extension and training services.

(k) Encouragement of bilateral and multilateral agreements for the exchange of raw materials, sources of energy and the construction of machines and implements and their associated components and replacement parts.

(l) Facilitating collaboration with international organizations in this domain, and making it more beneficial, by finding a more appropriate and viable means for the setting up of projects and employment of experts.

138. Clearly, it is first necessary for States to take the decision to draw up a policy with this objective in mind, underpinned economically and socially and supported by a great effort in all related sectors. Material aid and guidance by specialized institutions, including international co-operation, should be included in these proposals.

4.3 Examples of endeavours made in countries visited

139. If we analyse the endeavours made throughout the world to change the situation described above, we can state that they are many and varied, aimed at resolving a variety of industrial, agricultural and social problems. We can also say that, in our view, a large number of these efforts have been in the right direction and have borne fruit or will do so and any strategy drawn up subsequently must take them into account. In the case of others which did not achieve the benefits hoped for it would be advisable to modify their conception and orientation in the future.

140. Among the former are those aimed at establishing infrastructures, material and technical bases, training and development in applied technology at national or regional level, with their own resources and adapted to local conditions and industrial, agricultural, economic and social needs. Among the ones which in our view do not play a decisive role are those involving transfers of technology from developed countries which cannot be assimilated under current conditions and which generally fail as soon as technical assistance is withdrawn, so that they have no lasting impact and even fewer possibilities of being introduced on a wide scale.

141. For reasons such as these, it is better that resources invested by countries, under bilateral agreements and through international organizations, should be directed towards projects which pursue the former aim, to act as a driving force for development. If they are employed to a different end, the expenditure is high and the technologies remain merely superimposed without significant benefits. Gradually, as developing countries make socio-economic progress, they can proceed to introduce, through mutually advantageous contracts, those technologies which they are able to assimilate, even if they are not capable of generating them.

142. The foregoing is already happening in some developing countries which have achieved these transformations through favourable agrarian structures, centrally planned economies and a socio-political system which includes the fullest participation of farmers. Advanced technologies are also being applied in areas of modern agriculture in market economy countries generally involving large national or transnational enterprises whose economic resources make such development available to them. Our objective should be to achieve such development for all today's impoverished areas; they have a right to achieve it and all have the duty to assist them.

143. The efforts being exerted in this connection by the countries we visited and which we were able to observe, include those studies being carried out jointly by the Economic Commission for Africa (ECA) and the United Nations Industrial Development Organization (UNIDO) and the United Nations Food and Agriculture Organization (FAO), centred on Ethiopia, and aimed at determining the material and technical possibilities in the region for the manufacture of agricultural machinery and its introduction into agriculture in various countries. There is little doubt that this can provide the opportunity for full co-operation in the region under an integrated plan with each country contributing, in accordance with its achievements in the field, for the benefit of all.

144. The African Regional Centre for Engineering Design and Manufacturing (ARCEDEM) at Ibadan, Nigeria, sponsored by the ECA in collaboration with the Organization of African Unity (OAU) and UNIDO, should represent a considerable step forward for industry and in particular agricultural machinery in the region. When its installations are finished and its staff of professionals, technicians and skilled workers complete, and if its budget and a reasonable level of supply is maintained, it could have a significant influence in the short term on training and machinery manufacture for various countries, overcoming the inertia and creating the basis for other subregional and national centres in the medium and long term. There is another centre for the Asian region and it would make sense to establish one in Latin America and the Caribbean.

145. In Mali there is a group of three centres devoted to agricultural machinery with which regional and international institutions and organizations are in collaboration: the Regional Centre for the Promotion of Agricultural Mechanization (CERPROMA) at Kayes; the Centre for Agricultural Machinery Testing and Research (CEEMA) and the Malian Society for the Study and Construction of Agricultural Material (SMECMA). All these organizations are working with technologies adapted to local conditions and as their plans are completed and extended, in an integrated form co-ordinated by the Ministry of Agriculture, they will become a broad-range aggregate for the industrial and agricultural development of the country, which in future may be extended to neighbouring countries, introducing its effects there and serving as a structural model which can be incorporated in their respective planning.

146. The National Institute for Agricultural Research (INIA) in Mexico, at its Cotaxtla experimental farm in Veracruz, has developed several prototype implements using animal traction, manufactured in its small workshop and in the Empresa de Avios y Accesorios Metálicos (metal equipment and accessories enterprise) for soil preparation, sowing, cultivation and simple methods of sinking wells and pumps for the extraction of water for irrigation. These implements, if mass produced in existing industrial units, could be widely distributed at acceptable prices, if at the same time proper use were made of the agrarian structures established through the Secretariat for Agriculture and Water Resources (SARH). The firm Servicios Ejidales S.A. (SESA) has begun to manufacture some of these implements.

147. The projects sponsored in Mexico by the United Nations Development Programme (UNDP), through UNIDO, on agricultural machinery and agro-industries, with the counterpart involvement of the Secretariats for Programme and Budget, Trade and Industrial Promotion, Agriculture and Water Resources and where other State bodies concerned, should play an important role beneficial to the people, particularly in rural zones, if the results are applied to social practice and if the rural population has the opportunity of active involvement through employment, facilities for producing raw materials, a guaranteed market and reasonable prices for their production.

148. We know that for several years the polytechnic schools in Ecuador have been working on the design and construction of various prototypes of agricultural implements for use with animal traction. This has been co-ordinated with the Ministry of Agriculture and Livestock (MAG) and has aroused the interest of industrial enterprises, but their manufacture has been limited by factors beyond the control of those who participated in their creation and those who wished to continue the process as well as those for whom the finished products were intended.

149. The small-scale industrialists in Ecuador, members of the Chamber for Small-Scale Industry and the National Federation of Chambers of Small-Scale Industries (FENAPI) speak out strongly for the need to increase production, based on the use of their capacities and possibilities of adaptation to manufacture the various implements and machines required by small- and industrial-scale agriculture. This, together with the interest shown by State institutions, such as the National Council for Science and Technology (CONACYT), the Centre for Industrial Development in Ecuador (CENDES), the National Directorate for Technical Assistance to Industry (DINATI) and the Ecuadorian Capital Goods Commission (CEBCA), could give an impetus to this branch if the appropriate conditions are established.

150. The last two of the above-mentioned institutions have requested UNIDO's support in providing an expert to carry out a national study on the equipment required by the farming sector and the possibilities of maximizing the domestic supply, which is something to which we attach particular importance, since it may contribute decisively to clearing the way and achieving the objective which the country is pursuing and also serve as a base for the region and thus support the international strategy which is being developed, and serve as a model for other national studies which are being prepared.

151. UNDP, through FAO, is implementing a project in Ecuador for Integrated Rural Development administered by the Secretariat of the same name (SEDRI) and with the participation of various other State bodies. This project is aimed at improving the living conditions of farmers in the area where it is being put into effect and will be reflected in decisions to extend it to other areas. The Ministry of Industry, Trade and Integration (MICEI) and the National Development Bank (BNF), which are linked also to the regional organization of the Andean Group or States signatories to the Cartagena Agreement, can have a positive influence on industrial and agricultural integration in the areas of agricultural machinery and mechanization, respectively.

152. In Cuba, after the triumph of the revolution in 1959 and with the adoption of the socialist system for the development of the country, conditions were created for carrying out a fundamental agrarian reform and the eradication of hunger and poverty in rural areas, with a broad integrated plan which in a few years made it possible to achieve diversified, intensified and at the same time specialized agriculture, with a high degree of mechanization to make it increasingly productive and efficient. Public sector farm lands are organized into farm enterprises depending on the type of crop or livestock and agro-industrial sugar aggregates for

sugar cane; all of these are on a large scale facilitating the application of the best technology for mechanization, irrigation, new varieties and breeds, nutrition and health protection. The administration of all this activity is the responsibility of the Ministries of Agriculture (MINAGRI) and the Sugar Industry (MINEZ), respectively.

153. All the farmers are members of the National Association of Small Farmers (ANAP) and they have voluntarily joined the greater proportion of their land to Farm Production Co-operatives (CPA) and thus have access to the above-mentioned technologies, favourable credit systems, the required technical assistance and a guaranteed market for their products with stable prices. A smaller proportion keep their land holdings linked to service and credit co-operatives, which are also served by ANAP with the State providing all the necessary facilities to develop production and improve standards of living.

154. In order to cope with this increase in agricultural activity, with the insufficiency of rural labour and with the objective of alleviating the hard labour of small farmers and farm labourers, a mechanization programme was set up which has progressively introduced tens of thousands of tractors and considerable quantities of implements and agricultural machines of a very wide variety of types. Today there are mechanized systems for most of the productive processes both in crop and livestock production, which are constantly being improved.

155. With regard to the utilization of water resources the country has implemented a vast programme of work projects for the construction of dams and utilization of water for irrigation and to satisfy other socio-economic needs for water. The exploitation of underground water is also controlled to maintain its level and avoid soil subsidence, and drainage works are being carried out to improve or recover areas of land and prevent flooding. The Institute for Irrigation and Drainage Research (IARD) of MINAGRI is involved in all these activities, with particular emphasis on the study of irrigation schemes and systems exploitation.

156. There are three ministries directly involved in the manufacture of agricultural machinery, including irrigation equipment: Ministry of the Steel Engineering Industry (SIME), MINAGRI and MINAZ, which have a number of manufacturing enterprises whose output ranges from manual tools, implements for use with draft animals and tractor-drawn machines to combined sugar harvesters, the main components for sugar refineries and a number of agro-food industrial plants. Design, construction and testing of prototypes, together with general research, is carried out by the relevant institutions, for example the Institute for Farm Mechanization Research (IIMA) of MINAGRI, which has a testing station of international standing which can grant test certificates to both domestic and imported machines.

157. In addition, the infrastructure and material base have been established for the standardization, control, maintenance and repair of the machine and tractor stock, including a national network of workshops ranging from those for dealing with various levels of farm units to those at provincial and national level for major repairs. With regard to training the necessary personnel, there are schools throughout the country where workers can obtain qualifications in a variety of farming, operating and repair activities; technical schools to prepare middle-level technicians; and agricultural and politechnical institutes to train university-level professionals in a variety of specializations. The Ministries of Agriculture (MINAGRI), Education (MINED) and Higher Education (MES) are involved in this education process.

158. The Higher Institute for Agricultural Science in Havana (ISCAH), which belongs to the MES, acts as a science teaching complex in the domain of

agriculture. It has a Farm Mechanization Centre (CEMA) which is devoted to scientific research closely linked to a faculty for training farm machine engineers. This institute includes three other research centres: National Institute for Agricultural Science (INCA), Institute of Animal Science (ICA) and National Centre for Agricultural Health (CENSA), with which the Faculties of Agronomy, Livestock and Veterinary Medicine are respectively linked, and in addition to which there is a Irrigation and Drainage Faculty, and these together train high-level professionals in seven specialist areas.

159. ISCAH has experience in international co-operation since it acts as host to many specialists and its teachers and researchers have collaborated with many countries. It has admitted hundreds of students from developing countries whom it it has trained so that they could take their knowledge back to their respective peoples. It also provides post-graduate training and studies and is authorized to grant scientific degrees to national and foreign specialists.

160. The José Antonio Echevarria Technical Institute has a Machine Construction Faculty which trains mechanical engineers in this field. The persons so trained play a decisive role in machine manufacture in general and particularly agricultural machinery. They also carry out scientific research, with part of their programme devoted to specific work on agricultural machinery.

161. All these advances have been achieved in Cuba through the State's constant attention to industry and farming, giving priority to their development, and through the full participation of workers and farmers and other sectors involved as well as significant co-operation received, primarily from the socialist countries, on the basis of principles which favour this kind of development, and co-operation provided by international organizations which have sponsored projects to this end.

162. For all the above-mentioned reasons, we consider that Cuba is well fitted to contribute, in collaboration with other countries, to the success of the strategy which has been agreed on a worldwide basis and more specifically for Latin America and the Caribbean. It has the facilities for hosting the headquarters of a Regional Centre for Design and Manufacture with particular emphasis on agricultural machinery, similar to those which already exist in Africa and Asia, so that all the regions where developing countries are geographically located are thus covered.

163. Lastly, we can confirm that all the officials and specialists we contacted have expressed great interest in being directly involved and co-operating in implementing decisions and agreements which may be taken for this purpose, which more than ever encourages us to continue working hard to achieve progress in relieving the tense situation in which the developing countries find themselves.

CHAPTER 5

CONCLUSIONS AND RECOMMENDATIONS

5.1 Conclusions

164. Having analysed the information drawn from the documents studied and the evaluations made thus far of the efforts that have been expended and of those which are planned, and in order to describe other matters which we consider to be of fundamental importance, we are setting out the following general and specific conclusions.

5.1.1 General conclusions

165. In these conclusions we are combining a number of theoretical and general aspects which must be borne in mind in view of the current international situation and also matters which we surmise to be of relevance to the immediate future, if we want our purposes to be crowned with the hoped-for success. These are as follows:

(a) In order to achieve success with any strategy for promoting the agricultural machine industry in the developing countries, the main premise is the creation of specific technological and economic conditions in small and medium-scale manufacturing enterprises so that they can produce machines adapted to the needs and requirements of less developed agriculture, in the first stage of industrial development.

(b) Similarly, in order to achieve success in the intensification of mechanized agriculture in these countries, specific economic conditions have to be created to permit the introduction of the machines in the production sphere of small and medium-scale agricultural undertakings. The subjective factors which are always present in this type of action also have to be overcome. These are factors which enter into the first stage of development towards higher forms of production.

(c) In general terms, the manufacture of farm machines to satisfy the requirements of agriculture in the developing countries could be based on the following approaches:

- Domestic production in small and medium-scale enterprises in these countries, taking advantage of regional co-operation;

- Production in the small and medium-size enterprises of developed countries for sale to developing countries;

- Participation by large national or transnational enterprises, with adaptation of capacities for the production of suitable machines, until machines of greater complexity can be mastered.

The most favourable of these three approaches is the first, especially if we think in terms of integrated development of the countries concerned, bearing in mind the advantages which this offers and which we have analysed above. In the short term, utilization of all these approaches could have a greater effect, since the second one could lead to the speedier introduction of the machines needed and the third could result in greater sophistication in a shorter time. However, it should always be remembered that all the requirements should be combined and that the financial transactions should be favourable to the developing countries.

(d) The ways in which any of the above-mentioned approaches may be successfully pursued are as follows:

- By the efforts of the developing countries themselves, mobilizing resources for the development of their domestic industry and securing regional and international co-operation for creating infrastructure, providing training and obtaining the necessary technology.

- By the industrialized countries assuming responsibility for this development, contributing the above-mentioned resources under advantageous conditions for the less advanced countries, thereby compensating in part for what they have removed from those countries over a period of many years under the colonial or neo-colonial systems or simply by the unjust economic order imposed.

In our opinion, the first of these approaches is the most reliable: its results may perhaps be slower in coming but in the long term they are more comprehensive, longer lasting, more suitable and, above all, the most natural. However, the second approach must be borne in mind and a combination of the two of them achieved, since it is high time that people who live without experiencing the torture of hunger should contribute resolutely and disinterestedly so that those who are struggling between life and death may also be able to live. This would be the contribution of those who are able every day to select what they will eat on the morrow, because they have much to choose from, to those who must anxiously ask themselves what they will eat tomorrow because nothing is available to them.

(e) The world economic crisis which affects all countries and mainly those with market economies but which also has harsh effects on the developing countries, is doubtless the main cause of the narrowing down of the road which they must take in the search for new horizons for their industry and agriculture and other sources of wealth.

(f) Turning from this task, we must also draw attention to the need to embark on the transformation of the technological process of war to that of peace. The vast majority of the raw materials which are invested in the armament industry can be used in the agricultural machinery industry and a large percentage of the industrial capacity for producing weapons can be converted to the production of farm machines. For example, a tractor has technological characteristics similar to those of a military tank, but its purposes are completely opposite; the former is an instrument for life, the second is an instrument for death.

(g) The vast sums of money which are used for military purposes should be appraised with a view to channelling them to peaceful purposes, such as paying the external debt which is overwhelming the poor countries, paving the way to a more just economic order and promoting the development of the countries of the so-called third world. With only one per cent of the overall budget for military purposes, the needs of the developing countries for agricultural machines could be satisfied in five years.

(h) Similar steps could be taken to meet the other agricultural needs of these countries and to provide them with the technical infrastructure and inputs which would enable them to increase their production and productivity considerably. By pursuing this path, which is beneficial for humanity as a whole, we can also solve future problems of health and education and in this way achieve the balance which these peoples so long for.

(i) In the international context, we must also work towards achieving new and more advanced systems of agricultural reform which will enable the farmers to improve their living conditions and to make more and better products for the population as a whole through integrated rural development plans, in accordance with the characteristics and conditions of each country.

(j) Another area of action is that directed towards arriving at agreements putting an end to protectionism, unequal trade and other measures of economic extortion imposed by most of the industrialized countries on the developing countries, i.e. to seek to arrive at a new and just international economic order.

(k) In this connection, the unity which can be achieved by the less developed countries in connection with their main problems is a decisive factor in the solution of those problems. The identification, cohesion and collaboration between them will lead to victory in the pursuit of development.

(l) In short, taking into account the factors analysed above and in view of the profound crisis affecting the developing countries, the contributions of international organizations and bilateral agreements to projects for the agricultural machine industry and to agriculture and its mechanization do not represent significant advances in this area and all we get are isolated solutions of specific problems in some countries. Hence there is an imperative need for a programme which is international in scope and which will tackle the situation on an integrated basis with the active participation of all the factors which are directly or indirectly involved in these branches.

5.1.2 Specific conclusions

166. From the general conclusions we can deduce what measures are indispensable as a result of the adoption of a firm and resolute position by the small and medium-scale industrial and agricultural enterprises, the States, and the subregional, regional and international organizations which can make possible the establishment of conditions and provide the facilities for the entire process that we are advocating with a view to improving the present situation and guaranteeing the future of the developing countries in the domain under study. The following conclusions should be viewed against this background:

5.1.2.1 With regard to industrial enterprises

167. An important consideration in this entire action is the role played by the small and medium-scale enterprises for the manufacture of agricultural machines, or those which can be adapted fo this purpose. The following conclusions must apply to them:

(a) In order to make a start towards our goal of stimulating the agricultural machine industry, we have to have an idea, in terms of design, of the need for and benefits of constructing machines for small and medium-scale agricultural enterprises, until such time as higher levels of development can be reached.

(b) We then have to define, from the material point of view, their installed capacities, taking into account the nature of multiple production and the possibilities of adapting and expanding them.

(c) A very good idea is to provide for the participation of farmers so that they can express their views on what characteristics the machines should have in

(d) Support should be provided for training the farmers in the proper operation of the machines as well as in maintenance and minor repairs. Similarly, their own training should be developed.

(e) To ensure the efficiency of the machines and to prolong their service life, the factories themselves should guarantee the supply of spare parts and, if possible, tools for workshops.

(f) Achieving suitable integration of the production units is a decisive step towards success. For this reason we should encourage, stimulate and cordially welcome various forms of associations and co-operatives in these industries (ranging from the simpler to the more advanced types).

(g) The main guiding principle of these enterprises should be not to grow weary during the stage of development but to struggle on until they attain more modern technologies, specializing their production and raising their efficiency and productivity in order to produce more and better agricultural machines at prices corresponding to the growth achieved in agriculture and cattle breeding.

(h) The participation of these enterprises in the national and international efforts being exerted in the context of the strategy for promoting the agricultural machine industry is essential for their own success.

5.1.2.2 With regard to agricultural enterprises

168. Agriculture, as a natural factory producing raw materials, must advance in parallel with industry and the attainment of this objective calls for effective action on the part of small and medium-scale agricultural enterprises. To achieve this objective, we must take the following conclusions into consideration:

(a) Initially, in order to make a start on the proposed mechanization of agriculture, it is necessary to have an idea, in terms of design, of the need for and benefits of such mechanization on small and medium-scale farms until higher forms of production are reached.

(b) Next, there must be a definition in material terms of the requirements for agricultural machines, tools and other inputs as a function of the characteristics of the areas, the crops or the cattle-breeding being developed.

(c) The farmers must expound their ideas to the machine-building firms so that the agricultural machines which they get are designed to meet the technical requirements for adaptation to their farms.

(d) To improve their skills and to achieve better results in their production process, the farmers should take part in the training programmes made available to them and also take steps on their own initiative.

(e) The efficiency and service life of the machines are an inseparable aspect of the rural economy and therefore it is necessary to establish conditions for the proper utilization, maintenance, repair and conservation of the machines, such as parking areas, storage areas and workshops, and also for the availability of trained personnel.

(f) Rural integration in connection with agricultural reform processes has a historical tradition and now more than ever we should further, encourage and support the formation of associations and co-operatives among farmers, ranging from

(g) In order to speed up development it is essential, once primary requirements have been met, as a matter of principle to invest earnings from the larger harvests obtained in the gradual improvement of production machinery and technology in general but without neglecting the social needs of those who work the land.

(h) The participation of these enterprises in the national and international efforts being made in connection with this strategy for intensifying the mechanization of agriculture is also essential from the point of view of their own success.

5.1.2.3 With regard to States

169. Member States should, through their respective Governments, act as guarantors of co-ordinated national action for giving effect to whatever programme is set up, through internal decisions or in co-ordination with regional and international organizations, contributing the country's effort and properly channelling the co-operation made available. To this end the following conclusions should be taken into account:

(a) As a starting point, it is important that the Government, in all its organs and at all levels, should be aware of the need for developing the agricultural machine industry and the mechanization of agriculture in general.

(b) To begin with, a study should be made, in all feasible detail, to determine the possibilities and requirements for promoting the above-mentioned objective and to design a policy for achieving it.

(c) A very appropriate and necessary step will be that of analysing, in accordance with the characteristics of the country, the factors involved in the introduction of associative and co-operative forms of production, and of establishing the appropriate infrastructure and legal basis. Where such arrangements are already in place, they should be strengthened and improved.

(d) It is essential to establish systems for granting medium- and long-term credit at low interest rates, primarily to farmers, for the purchase of machines and for the production process in general.

(e) Conditions should be created for the adaptation, expansion and full operation of the installed capacity of national enterprises for the manufacture of tools and equipment as well as of agricultural machines and spare parts and components for them. The development of new industries should be promoted, due attention being paid to the rural areas in which they are to be located.

(f) At the same time a plan should be drawn up for agro-industries linked to agriculture, with the participation of farmers located mainly in areas producing raw materials. This would be with a view to reducing the volume of transportation and increasing employment in these areas.

(g) One of the most urgent measures is the drafting of a national plan for meeting training requirements, from the skilled worker level to the university-trained professional, in the numbers and quality needed by industry and for mechanization in agriculture.

(h) In order to stimulate production, it would be advisable on the part of the enterprises to devise new marketing systems or to adapt existing ones so as to facilitate the acquisition of inputs both for industry and for agriculture, exempt from customs barriers or other obstacles, and also to guarantee the sale of output at prices favourable to the farmers.

(i) Governments should provide all necessary support and participate with determination in regional and international efforts to support the strategy being promot[illegible] in this area in the developing countries.

5.1.2.4 With regard to organizations

170. Special importance attaches to the essential role which should be played by the international, regional, subregional and national organizations in connection with the agricultural machine industry, agriculture and the mechanization of agriculture in organizing and providing guidance for programmes and, in general, monitoring their implementation. We deem it necessary for the following conclusions to be taken into account:

(a) It is desirable to continue encouraging and supporting the establishment of regional and national centres dealing with industrial development and giving priority to agricultural machines. From the regional point of view, the immediate creation of a centre for Latin America and the Caribbean can be recommended as a means, together with the centres for Africa and Asia, of covering the three areas in which the countries of the so-called third world are physically located.

(b) It would be very advantageous if these centres, in co-operation with FAO, could participate more fully in the development of agricultural machines, not only as regards design and construction of prototypes as well as testing and experimentation, but also in giving guidance to the institutions responsible for extending mechanization and for providing services - this with a view to improving operations and ensuring that experience rapidly results in the development of new designs.

(c) An analysis should be made of the possibility of laying it down as a policy to be followed at the present stage that, basically, the projects sponsored directly by the organizations or the agreements co-ordinated between countries should be directed towards creating the infrastructure and technico-material basis for industrial development and the incorporation of agricultural machines in the argriculture of the developing countries.

(d) It is also important to pay particular attention to projects related to the foregoing which are already in the process of implementation, those which are being designed, those which have been requested and, above all, those which consider the requirements and possibilities of a country in this respect. Some of these have been mentioned in this report.

(e) These organizations should be used as a channel for supplying Member States with necessary information and providing them with technical support for the planning of centres for training, testing and experimentation, as well as for extension courses and services to industry and the mechanization of agriculture. It is recommended that these centres should form a harmonious structured whole based on integrated teaching, scientific, technical and social activities, depending on national and regional interests.

(f) In the co-operation projects, consideration should be given to arranging that the assistance of the donor party should continue until the results have made themselves felt in social practice and until the beneficiary can provide assurance on its own account that the application of the results of the assistance will be continued.

(g) The organizations, and especially UNIDO, should work at various levels towards achieving greater collaboration on the part of the developed countries not only with regard to financing but also to technical assistance and to suitable technologies for the agricultural machine industry and the mechanization of agriculture. In this connection, account should be taken of the experience of the socialist countries, which have contributed successfully to the development of a number of countries in this respect.

5.2 Recommendations

171. On the basis of the conclusions summarized above and, in particular, the words of the final general conclusion, the following are the recommendations that must be put into practice in order to implement the strategy we are proposing:

5.2.1 General recommendations

172. In order that this strategy may be set out as clearly and fully as possible and that the programme may be organized, planned, executed and monitored in a feasible manner, with the technical assistance and financing distributed fairly, and so that it may be developed as quickly and effectively as possible, it is necessary to take a few prior decisions which we indicate below in the form of general recommendations:

(a) **UNIDO should collaborate with FAO to analyse the need for and advisability of the two organizations participating in the entire development of this programme**, so that the policies to be adopted in the agricultural machinery industry and in the mechanization of agriculture may be harmonized. This is the path to greater and better achievements, since work done separately requires more effort and results are generally poor and short-lived.

(b) The programme should be **universal in scope**, so that all developing countries may participate and all developed countries may co-operate. If it has this scope it will be recognized and supported by the relevant international organizations and institutions.

(c) The programme should be **of indefinite duration**, with the periodic adjustments required by the rate of activity being achieved, until the present-day imbalance between the less developed countries and the industrialized countries, referred to several times in this report, has been eliminated.

(d) This programme, by its universal and permanent nature, should be incorporated in the **general programme of work of the United Nations** and receive the resolute backing of the member countries.

(e) UNIDO and FAO should approach UNESCO and ILO to seek their collaboration in those areas of the programme covered by their activities.

(f) UNIDO and FAO should approach the regional and subregional organizations and institutions to ask them to give the greatest possible attention and co-operation in the areas of the programme which relate to their own activities and to persuade the member countries to play an active part in this entire development process.

(g) UNIDO, in collaboration with FAO, should appoint a general programme co-ordinator and both organizations should each designate an expert for the central formulation of the plan of their respective branches and for the harmonious integration of those plans in the single programme.

(h) The **Regional Centres for Design and Manufacture should be given responsibility for co-ordinating the programme in their respective regions**, in conjunction with the structure of FAO at this level, doing so through UNDP. In order to ensure that this is done it will be necessary to strengthen these centres with a small number of personnel, i.e. one or more experts, depending on the volume of work involved and in fulfilment of the following recommendation.

(i) **A Regional Latin American Centre for Engineering Design and Manufacture**, with its headquarters in the Republic of Cuba, should be established under the conditions already analysed in this report so that it may begin work immediately with this objective in mind and gradually develop the final project.

(j) **The national projects agreed upon should be executed in their entirety by the countries concerned**, which shall receive the necessary information and guidelines, as well as the technical and material resources stipulated, in co-ordination with the Regional Centres, through UNDP. The Government of each country shall appoint an official who is experienced in industry and another who is a specialist in agriculture to take part in drafting the projects and to direct the execution thereof.

(k) The financial, technical and material inputs provided under the bilateral agreements should be used to support the budget allocated by the Governments for the execution of the national projects. In this context account should also be taken of the participation of the industrial and agricultural organizations, institutions and enterprises in each country.

(l) The regional and subregional organizations and institutions should contribute technically and economically to the work being done by the regional centres responsible for co-ordinating the programme at this level.

(m) The budgets allocated by UNIDO and FAO, together with the co-operation of other international organizations, should be used primarily for the planning, organization, guidance, supervision and monitoring of the programme, covering central personnel, technical and material resources for formulating the projects, training of specialized officials to direct the projects and the contribution to the regional centres.

(n) UNIDO and FAO, with the direct support of the United Nations, should explain to the industrialized and donor countries in general the need for them to make **new contributions to this programme** and to provide suitable technological and technical/scientific facilities for it.

(o) UNIDO and FAO should approach the United Nations in order that, through the established channels and supported by all interested parties, it may launch a **world campaign to promote the use of part of the overall military budget to solve the problems affecting developing countries**, e.g. 1 per cent per annum, as already mentioned, for the manufacture of agricultural machinery and its use in agriculture in those countries.

(p) FAO should encourage the **reactivation and expansion of world agrarian reform** in order to build on foundations already laid and to lay new ones for improving the life of the farming community, guaranteeing its survival and that of the entire population, releasing it from the tragedy of hunger which is spreading rapidly like the most terrible epidemic suffered by humanity.

(q) The formulation of the general programme and of the projects deriving from it **should include and benefit from all that has been done in the past** in the various areas concerned. This recommendation is based on the principle of ensuring the continuity of the work being done and of applying the results achieved.

(r) The organizations, institutions and States involved should revise current regulations governing treaties, conventions, contracts and other forms of mutual relations, stressing those which govern economic transactions, with the aim of tailoring them as far as possible to the needs, requirements and forms of work connected with the various activities making up the programme in its full extent.

(s) UNIDO and FAO, through UNDP, should analyse, between themselves and with the other institutions and organizations connected with the programme, the manner in which their officials, resident representatives, experts, consultants and other specialists seconded to the various countries should participate in the programme.

(t) Efficiency and economy should be predominant factors in preparing the programme so that the greatest benefit may be derived from the results using available means and resources. It is essential, in order to achieve this aim, that all physical and mental capabilities should be applied to the work.

5.2.2 Specific recommendations

173. In order to arrive at a **PROGRAMME** to synthesize the **INTERNATIONAL STRATEGY** to **PROMOTE** the **AGRICULTURAL MACHINERY INDUSTRY** and to **INTENSIFY AGRICULTURAL MECHANIZATION** in **DEVELOPING COUNTRIES**, the following specific recommendations must be implemented:

(a) A meeting of experts should be called to discuss and approve the strategy presented in this document with an outline of the programme for carrying it out, at which both branches, industry and agriculture, should be present - that is to say, representatives of UNIDO and FAO.

(b) The joint UNIDO/FAO programme should be drafted, with due allowance for the guidelines drawn and the observations made at the meeting. This programme, which will contain everything that it is recommended to do in the agricultural machinery industry and in agricultural mechanization, will be drawn up by the experts appointed by both organizations.

(c) A meeting of the administrators of UNIDO and FAO should be called to discuss and approve the joint programme and the administrative provisions governing it.

(d) The Regional Economic Commissions should be asked to include on the agenda of their next meeting at item covering the presentation, discussion and approval of the programme at that level, so that the observations of each may be included. The general co-ordinator, central experts and experts from the regional centres in the respective regions should participate.

(e) A joint UNIDO and FAO communication should be sent through the proper channel to the Heads of State or Government of the developing countries to explain the aims of the programme, the benefits it offers, the need for each country to participate in it and a request for their consent thereto.

(f) The documents to be submitted to a regional seminar should be produced on the basis of the joint programme and the decisions taken at the meetings of the Economic Commissions; they should include a survey of the current situation and of the prospects of the agricultural machinery industry and agricultural mechanization; guidelines, general regulations and methodologies for case studies to be made in these fields in the countries concerned, and also for the formulation of the projects which are to be promoted. These documents should be produced by the central experts designated by UNIDO and FAO.

(g) UNIDO, FAO and the Economic Commissions should organize a seminar in each of the three regions to present, discuss and approve the documents referred to above. These seminars should be organized by the Regional Centres co-ordinating the programme with the participation of the general co-ordinator, central experts and experts from the Regional Centres, as well as specialized officials appointed by each country, in their respective regions. If possible, they should be arranged so that they coincide with the meetings of the Regional Economic Commissions to rationalize organizational resources and efforts.

(h) UNIDO and FAO should recommend, through the Regional Economic Commissions, that a national meeting be held in each country which has decided to participate in the programme, under the direction of the specialized officials, with the participation of other government officials concerned in these areas and representatives of industrial and agricultural enterprises. The meeting should analyse and approve the initial study to be made in the country, seeking the support and co-operation of all parties concerned, and assess the prospects of the programme and the projects planned for the nation.

(i) A survey should be made in each country, using methods to be determined, to collect information for the formulation of national and regional projects, in line with requirements, needs and possibilities. This survey, to be carried out by the Governments, would contain details regarding:

- Availability of raw materials and energy sources.
- Factories and workshops, with their capacity and degree of utilization, types of production and possibilities for adaptation and extension.
- Need for manual tools, animal-drawn implements, motorized machinery and tractors.
- Forms of landholding and soil exploitation, area patterns and background regarding associations and co-operatives.
- Facilities for the industrial and agricultural market, purchase of inputs and sale of products.
- Existing credit and tariff systems and possibilities of adjusting them to the proposed programme.
- Training levels in these branches, with possibilities for extension and specialization.
- Installations for the design and construction of prototypes, testing and machine trials.
- Background regarding results of projects carried out in this field by regional and subregional organizations and possibilities of expanding co-operation.
- Infrastructure of the State for directing these branches of activity within the country and national institutions and organizations connected with them.
- In addition, suitable proposals regarding possible work or projects to be carried out in the country.

(j) The information gathered from the survey of each country would be processed by the experts in the Regional Centres, who would prepare a summary of the needs and possibilities to be fulfilled at the national and regional levels. This summary and the suggestions made by the respective countries would generate the proposals for the package of projects to be formulated, depending on the situation and conditions in each country and the co-operation between countries that is deemed to require support, bearing in mind the following aspects which are given by way of example:

- Reactivation or rehabilitation of existing workshops and factories producing agricultural macninery and spare parts.
- Expansion, adaptation and/or modernization of existing workshops and factories for the same purpose.
- Creation of new workshops and factories to produce the same or new agricultural machinery.
- Reactivation, rehabilitation or expansion of existing workshops for the repair of agricultural machinery and the creation of new ones.
- Expansion of the services to the agricultural machinery industry and the creation of new services.
- Training of workers in the industry: machining, casting, forging, heat treatment etc.
- Training of operators of agricultural equipment.
- Training of operators of irrigation equipment.
- Training of mechanics to work with industrial and agricultural machinery.
- Promotion of integrated agro-industrial development in rural areas.
- Rehabilitation and recuperation of agricultural areas suitable for mechanization.
- Expansion of facilities to conserve water supplies.
- Improvement and expansion of irrigation systems.
- Adaptation and expansion of areas for irrigation.
- Perfecting of technologies for the use of renewable energy sources.
- Perfecting and expansion of technologies for the conversion of other raw materials for industry and for agriculture.
- Rehabilitation and/or expansion of existing centres for the design and construction of prototypes, testing and agricultural macninery trials.
- Promotion of the market for the purchase of inputs for industry and for agriculture.
- Promotion of the market for the sale of agricultural machinery and agricultural and livestock products.

- Reactivation, stimulation and extension of associations and co-operatives which exist for industrial and agricultural production connected with agricultural machinery.

- Creation and development of new forms of associations and co-operatives in both areas.

(k) When proposing projects to be carried out by countries at the first stage of executing the programme, with regard to the manufacture of agricultural machinery, the experts from the Regional Centres should indicate the feasibility of the projects on the basis of a comparison between the complexity of each project and the true possibilities for the country or countries concerned of implementing the project. The following are some examples giving the central element of a project and the extent to which it may be developed.

- Manual tools for agriculture: all countries would manufacture them.

- Agricultural implements drawn by animals: most countries would manufacture them and some would supply them to those which cannot manufacture them in each region.

- Motorized agricultural machinery: some countries would produce this in the plants they possess or in new plants they may decide to build and would market it to the other countries in the region and, in some countries, to other regions which do not produce it.

- Agricultural tractors suitable for the agriculture and livestock conditions in these areas: a few countries would manufacture them using the industry they possess and would promote supply to other countries within the three regions which do not have the possibility of manufacturing them.

- Self-propelled combined machinery: a few countries would manufacture this in the plants they possess or in other new plants that they may decide to build and they would introduce it to the other countries in the three regions which need it.

- Hand-operated water pumps for irrigation and other needs: all countries would manufacture them.

- Mechanically-activated water pumps (larger capacity): some countries would produce them and market them in the remaining countries which do not produce them in the region, including marketing between regions.

- Irrigation systems: a few countries would manufacture them in the factories they possess or in new ones they may decide to build and would supply them to the countries in the three regions which do not manufacture them.

- Manufacture and recovery of spare parts: all the countries would produce spare parts for the machinery they manufacture and all those parts and components needed for the machinery they import and which can be manufactured with the resources at their disposal.

- Reactivation or rehabilitation of workshops or building of new workshops for the repair and maintenance of agricultural machinery: all countries would develop this activity.

- Training: all the countries would provide training to the extent of their needs, except for those cases in which the complexity of the work to be done remains the specialized field of only a few countries and they would train workers for the rest of the region in specific subjects.

All the other types of projects mentioned can and must be undertaken by the various countries, making appropriate use of regional and international co-operation.

(l) The project packages proposed for each of the regions should be sent to the central office for general analysis and selection of those which would be started immediately, along with scheduling of those for subsequent years. This selection will be made by the experts on the basis of the requirements, the available material, financial and human resources and the harmonious and equitable development to be achieved in each region, in the constituent subregions and in the countries they comprise, with subsequent submission by the general co-ordinator to the administrations of UNIDO and FAO, with the intervention of UNDP, for approval.

(m) The approved projects will be forwarded, via the Regional Centres and according to established rules, to the appropriate countries for execution, under the guidance and control of the regional experts and the direction of the specialized officials in each country.

(n) The activities should be supervised systematically in the established manner and the checking and evaluation of the results should be carried out annually by the Regional Centres with the participation of the organizations and institutions which co-sponsor the programme and the representatives of the central administration thereof.

(o) We suggest that the steps indicated so far should be taken in the three-year period 1986-1988 so that the projects will have been under way for two years by 1990 and it would thus be possible to evaluate this first stage of development of the programme, which we propose should be identified as the **FIRST FIVE-YEAR PLAN TO PROMOTE THE AGRICULTURAL MACHINERY INDUSTRY AND TO INTENSIFY THE MECHANIZATION OF AGRICULTURE IN DEVELOPING COUNTIRES.**

(p) The evaluation of the five-year period requires a preparatory phase to prepare the documents covering the results of the work done, on the basis of which the proposals for the second five-year plan will be made. These proposals will be analysed by a specially convened meeting. It is therefore necessary to make an annual check up to 1990 in order to obtain the necessary information in good time and in the desired quality, to enable the regional and central experts to carry out their prior task at their respective levels.

(q) The evaluation meeting in question should be held in each region towards the end of the first half of 1991 and all aspects of the design, organization and execution of the programme should be represented in order to select from the collective experience the successes achieved, so that they may be sustained, the mistakes made, so that they may corrected, and the deficiencies and difficulties noted, so that they may be overcome. Similarly, suggestions will be made for adjustments and modifications that may need to be made to the programme for the following five-year plan.

(r) During the organization of the programme, all projects that are being carried out alongside it should be continued and be given support until they are completed, while those which are being prepared should be re-oriented, provided that this is possible, with a view to fulfilling the targets of said programme.

(s) While the first five-year plan is in progress and subsequently, it would be advisable for the programme to be submitted for consideration by consultative meetings and other meetings concerned with the agricultural machinery industry and with the mechanization of agriculture for constructive appraisal of the general outline in order to make its foundation more secure and to ennance the results anticipated.

(t) Once the first five-year plan has ended and the second has begun, an **International Congress on the Agricultural Machinery Industry and the Mechanization of Agriculture**, to be held in a developing country, could be convened to extend the perspectives and to make a final consolidation of the universal nature of these areas of science and the need to develop them to the utmost.

174. The **second five-year plan 1991-1995**, building on the first one, will incorporate the experience gained and will bring the programme into full development, leading up to the third and final plan of the century with the greatest possible capacity to respond to the needs encountered. These will follow the same working principles and forms of organization which gave rise to this activity, conceived as an alternative solution to the problems of underdevelopment encountered particularly in the agricultural machinery industry and in the mechanization of agriculture in the countries of the so-called third world.

175. On the threshold of the year 2000, let us cover the developing countries with factories and workshops to produce agricultural machinery. We shall sow their fields with machines and we shall fertilize this development with trained men and women drawn from these peoples who cultivate their land with their bare hands and water it with the sweat of their brows so that it may bring forth the yearned-for fruits to satisfy the hunger which today afflicts a large part of humanity. We salute the twenty-first century by assuming the responsibility of putting into practice the international principles which form the basis of this document.